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## ABSTRACT

This packet contains an instructor guide and student reference for a course in introduction to dairy production. The curriculum contains the following six lessons: (1) introduction to the dairy industry; (2) breeds of dairy cattle; (3) principles of dairy cattle selection; (4) herd management; (5) herd health; and (6) industry issues. The instructor guide includes the following: objectives, competencies, motivational techniques, teaching procedures, other activities, activity sheets, transparency masters, evaluations, answers to evaluations and activity sheets, references and teaching aids, and materials and equipment lists. For ease of use, the guide includes competencies and objectives at the beginning of the guide as well as incorporated within each lesson. In addition, 22 references are listed. A competency profile is provided in the front of the guide for convenient recordkeeping. An appendix lists six dairy cattle associations with addresses and telephone numbers for further information. The guide incorporates the needed components to aid agriculture teachers to implement Vocational Instructional Management System (VIMS), a framework to use in planning and organizing to ensure excellence in Missouri's vocational education system by focusing greater attention on the management of teaching and learning. The student reference contains information sheets and summaries for each of the lessons. (KC)

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# Introduction to Dairy Production Instructor Guide Student Reference

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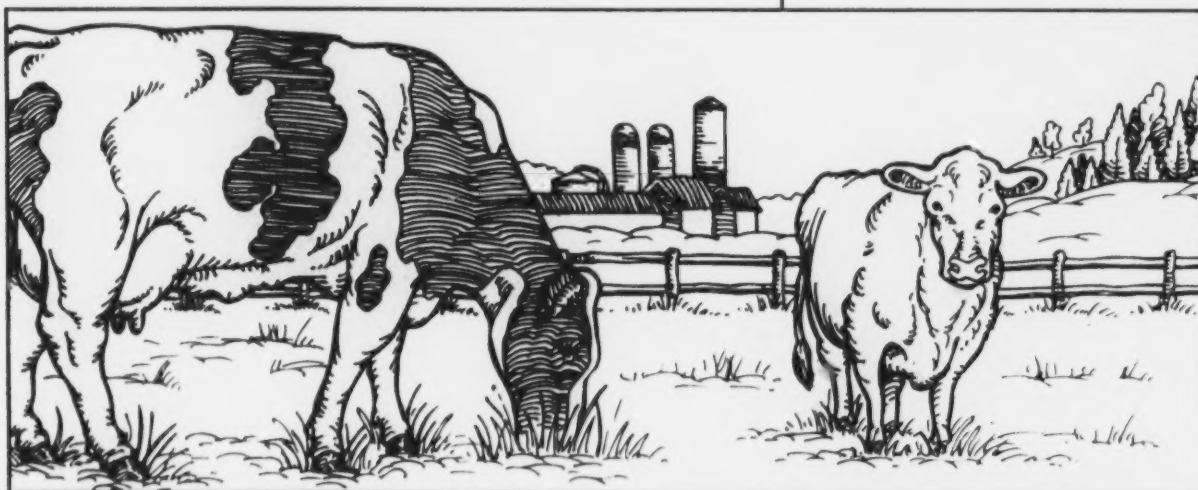
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Introduction to

# DAIRY PRODUCTION

instructor  
guide



in cooperation with  
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Arts and Vocational-  
Technical Education  
College of Education and  
College of Agriculture,  
Food and Natural  
Resources  
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University of Missouri-Columbia

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## INTRODUCTION TO DAIRY PRODUCTION

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## FOREWORD

The development of the *Introduction to Dairy Production* curriculum guide is the result of suggestions by the MVATA Teaching Aids Committee. The Dairy Production Advisory Committee suggested the topics to be included and reviewed the materials.

This curriculum contains six lessons. The instructor's guide includes objectives, competencies, motivational techniques, teaching procedures, other activities, activity sheets, transparency masters, evaluations, answers to evaluations and activity sheets, references and teaching aids, and materials and equipment. Topics include an introduction to the dairy industry, breeds of dairy cattle, principles of dairy cattle selection, herd management, herd health, and industry issues. One copy of the student reference is packaged with the instructor's guide. Additional copies of the student reference can be purchased separately.

During the summer of 1981, the Missouri State Board of Education formally adopted the concept of "Instructional Management Systems" (IMS) as a priority for the 1981-82 school year. The Missouri Commissioner of Education described the IMS concept as a practical way of "organizing for excellence" in education. To meet the demand for greater productivity and accountability, the director of Vocational Education applied the elements of IMS to form the Vocational Instructional Management System (VIMS). The VIMS process provides a framework to use in planning and organizing to assure excellence in Missouri's vocational education system by focusing greater attention on the management of teaching and learning.

This guide incorporates the needed components to aid agriculture teachers in the implementation of VIMS. For ease of use, competencies/objectives have been included at the beginning of the guide as well as incorporated within each lesson. A competency profile has been provided in the front of the guide for convenient record keeping.

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# INTRODUCTION TO DAIRY PRODUCTION

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### COMPETENCIES/OBJECTIVES

1. Describe the importance of the dairy industry in Missouri.
2. Identify the major dairy breeds in Missouri and their significance to the dairy industry.
3. Use available information to select dairy cattle.
4. List management factors important to profitable dairy production.
5. Develop a herd health program.
6. Evaluate issues concerning the dairy industry.

## EVALUATION

1. Give short, objective tests following each lesson and a more in-depth objective test at the conclusion of the unit.
2. Observe the changes in behavior as evidence of the improved ability of students to deal with problems in this unit using background information acquired from earlier units.
3. Observe students' attempts to solve similar problems in their supervised agricultural experience programs.

## REFERENCES AND MATERIALS

### 1. Student Reference

*Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.

### 2. Teacher References

#### a. Books

- 1) *1996 Missouri Farm Facts*. Columbia: Missouri Agricultural Statistics Service in cooperation with the Missouri Department of Agriculture and the U.S. Department of Agriculture, 1996.
- 2) Allen, Jan L. *Judging and Identifying Dairy Products*. Urbana, Ill: Vocational Agriculture Service, 1990.
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- 6) Lee, Jasper S., et al. *Introduction to Livestock and Poultry Production*. Danville, Ill.: Interstate Publishers, Inc., 1996.
- 7) Taylor, Robert E., and Ralph Bogart. *Scientific Farm Animal Production*. 3rd ed. New York: Macmillan Publishing, 1988.

#### b. Pamphlets, magazines, etc.

- 1) *Linear Classification System*. Brattleboro, Vt.: Holstein Association, 1996.

#### c. Extension publications

- 1) *How to Compute Your Cost of Producing Milk (G3651)*. University Extension agricultural publications, 1995.

#### d. Internet resources

- 1) Ames, N. Kent. "Hairy Heel Warts, Foot Rot, Founder: The Enemies." <http://www.canr.msu.edu/dept/ans/mdr211.html> (5 August 1997).

- 2) Department of Animal Science, Oklahoma State University. "Breeds of Livestock." <http://www.ansi.okstate.edu/breeds> (30 September 1997).
  - 3) Dougherty, Dennis. "Feeding Strategy." <http://www.moomilk.com/dairy/archive/nutrition-05.htm> (15 July 1997).
  - 4) Kennelly, John. "Nutritional Quality and Safety of Milk and Milk Products." <http://www.afns.ualberta.ca/dairy/dp472-4.htm#GENERAL> (15 July 1997).
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  - 11) Young, C.W. "Linear Type Traits." [http://www.inform.umd.edu/EdRes/Topic/AgrEnv/ndd/genetics/LINEAR\\_TYPE\\_TRAITS.html](http://www.inform.umd.edu/EdRes/Topic/AgrEnv/ndd/genetics/LINEAR_TYPE_TRAITS.html) (30 September 1997).
- e. Audiovisuals (available from the Missouri Vocational Resource Center, University of Missouri-Columbia, Columbia, MO 65211)
- 1) *Judging Dairy Cattle*. Video. Vocational Education Productions, 1988.
  - 2) *Artificial Insemination of Beef and Dairy Cattle*. Video. Vocational Education Productions, 1992.

## Introduction to Dairy Production Competency Profile

**Directions:** Evaluate the student by checking the appropriate number or letter to indicate the degree of competency. The rating for each task should reflect **employability readiness** rather than the grades given in class.

**Rating Scale:** **3 Mastered** - can work independently with no supervision  
**2 Requires Supervision** - can perform job completely with limited supervision  
**1 Not Mastered** - requires instruction and close supervision  
**N No Exposure** - no experience or knowledge in this area

| 3 | 2 | 1 | N |
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### Introduction to Dairy Production

1. Describe the importance of the dairy industry in Missouri
2. Identify the major dairy breeds in Missouri and their significance to the dairy industry
3. Use available information to select dairy cattle
4. List management factors important to profitable dairy production
5. Develop a herd health program
6. Evaluate issues concerning the dairy industry

Other: \_\_\_\_\_

## Introduction to Dairy Production

[illegible]

### Competencies

1. Describe the importance of the dairy industry in Missouri.
2. Identify the major dairy breeds in Missouri and their significance to the dairy industry.
3. Use available information to select dairy cattle.
4. List management factors important to profitable dairy production.
5. Develop a herd health program.
6. Evaluate issues concerning the dairy industry.

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 1: Introduction to the Dairy Industry

Competency/Objective: Describe the importance of the dairy industry in Missouri.

#### Study Questions

1. **What is the economic importance of the dairy industry in Missouri?**
2. **How has the dairy industry evolved?**
3. **What are modern trends in the dairy industry?**
4. **What career opportunities are available in the dairy industry?**

#### References

1. *Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
2. Activity Sheet
  - a) AS 1.1: A Career in the Dairy Industry

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 1: Introduction to the Dairy Industry

#### TEACHING PROCEDURES

##### A. Introduction

Through the consumption of dairy products, dairy production affects nearly every American. This dairy unit will discuss the industry, breeds of dairy cows, and principles and management of dairy operations.

##### B. Motivation

Obtain a milk carton from the school's cafeteria. Ask students to calculate how much a gallon of milk would cost if purchased in the lunchroom size containers. Compare that figure to how much the farmer receives. (Contact the local milk marketing cooperative or extension office for current milk prices.)

##### C. Assignment

##### D. Supervised Study

##### E. Discussion

1. Discuss the economic importance of the dairy industry to Missouri. Focus the discussion on your local community and region of the state. Profile leading dairy areas of the state.

#### **What is the economic importance of the dairy industry in Missouri?**

- a) In 1995, Missouri ranked eighth in the number of milk cow operations and thirteenth in milk production.
  - b) More than 190,000 head of dairy cows were present throughout Missouri.
  - c) Each cow produced an average of 14,158 pounds of milk per year.
  - d) The production of milk generated almost \$350 million of income.
  - e) The dairy industry is primarily located in southwest Missouri.
  - f) Wright County was the top dairy county as of January 1, 1996, with 16,650 head of dairy cows.
2. Ask how the dairy industry has evolved in the United States. Compare dairies of today with those in the nineteenth century.

#### **How has the dairy industry evolved?**

- a) The dairy industry began when settlers brought cows to America in the early 1600s.
  - b) Until the mid-nineteenth century, the owner of the cow consumed most of its milk; some milk and dairy products were sold to those nearby who did not have their own cows.
  - c) In the nineteenth century, technological advancements led to the growth of the dairy industry.
    - 1) Refrigerated railroad cars for transport to urban areas
    - 2) Pasteurization of milk
    - 3) Commercially produced cheese
  - d) These advances allowed dairy production to become a commercial business, with dairy operations supplying milk to many people.
3. Begin the discussion of question 3 by asking how dairy operations are changing. Discuss the differences.

**What are the modern trends of the dairy industry?**

- a) Decreasing number of operations nationwide with more cows per farm
  - b) Increase in milk production of existing cows, due to management factors such as the use of BST (bovine somatotropin)
  - c) Shift in the location of production from the Midwest to the western United States (California, Arizona, New Mexico)
4. Have students list careers associated with the dairy industry. Point out that most of the careers in the dairy industry are not in the production of milk.

**What career opportunities are available in the dairy industry?**

- a) Dairy producer
- b) Loan officer
- c) Geneticist
- d) Feed company representative
- e) Veterinarian
- f) Equipment sales and service representative
- g) Fluid milk hauler
- h) Processing plant supervisor
- i) Sales representative for dairy food products

**F. Other Activities**

Schedule a guest speaker who is actively involved in the dairy industry to discuss careers and the future of the industry.

**G. Conclusion**

The dairy industry is an important part of Missouri agriculture. Dairy producers are becoming larger and more efficient. Dairy production in Missouri is primarily centered in the southwestern part of the state.

**H. Answers to Evaluation**

- 1. c
  - 2. d
  - 3. c
4. Refrigerated railroad cars allowed producers to ship their milk long distances to urban areas. Milk began to be pasteurized. Commercially manufactured cheese became available.
5. Answers may include any three of the following: dairy producer, loan officer, geneticist, feed company representative, veterinarian, equipment sales and service representative, fluid milk hauler, processing plant supervisor, or sales representative for dairy food products.

UNIT - INTRODUCTION TO DAIRY PRODUCTION

Name \_\_\_\_\_

Lesson 1: Introduction to the Dairy Industry

Date \_\_\_\_\_

EVALUATION

**Circle the letter that corresponds to the best answer.**

1. How many dairy cows were found in Missouri in 1995?
  - a. More than 170,000
  - b. More than 180,000
  - c. More than 190,000
  - d. More than 200,000
2. Which area of the state has the most dairy operations?
  - a. Southeast
  - b. Northeast
  - c. Central
  - d. Southwest
3. Which of the following is a current trend in the dairy industry?
  - a. Increasing number of operations
  - b. Moving from populated to less populated areas
  - c. Increasing number of cows per farm
  - d. Decreasing milk production in existing cows

**Complete the following short answer questions.**

4. What changes in the dairy industry occurred in the nineteenth century?
5. What are three careers in the dairy industry?
  - a.
  - b.
  - c.

Lesson 1: Introduction to the Dairy Industry

Name \_\_\_\_\_

**A Career in the Dairy Industry**

**Objective:** Learn more about the dairy industry by conducting an interview with someone working in the dairy industry.

**Interview a person with a career in the dairy industry. Record his or her name, occupation, and place of employment. Use the questions on this sheet as an aid when interviewing the individual. Write down the answers to questions, as well as any other information that is important. Then, make a report about the career to the class.**

Name:

Occupation:

Place of Employment:

How long have you worked in your present occupation?

Why did you choose this career?

What training was necessary for this job?

What skills do you use?

What jobs have you had previously that helped prepare you for this one?

What other jobs have you considered?

What are your career plans for the future?

What advice would you give someone who is considering a career in this area?

Comments:

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 2: Breeds of Dairy Cattle

Competency/Objective: Identify the major dairy breeds in Missouri and their significance to the dairy industry.

#### Study Questions

1. What are the identifying characteristics and history of the six major dairy breeds in Missouri?
2. What factors influence breed selection?

#### References

1. *Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
2. Transparency Master
  - a) TM 2.1: Dairy Breeds
3. Activity Sheets
  - a) AS 2.1: Dairy Breeds
  - b) AS 2.2: Researching Dairy Breeds

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 2: Breeds of Dairy Cattle

#### TEACHING PROCEDURES

##### A. Review

Lesson 1 described the importance of dairy production to Missouri's agricultural economy and how the dairy industry has evolved. Lesson 2 will focus on the major breeds of dairy cattle and the selection of a breed for production.

##### B. Motivation

Obtain a photo of a red and white dairy cow, either a red Holstein or Ayrshire. Have students guess which breed it is.

##### C. Assignment

##### D. Supervised Study

##### E. Discussion

1. Discuss the six major dairy breeds, completing the chart on TM 2.1. Point out that Holsteins are by far the dominant dairy breed.

#### **What are the identifying characteristics and history of the six major dairy breeds in Missouri?**

- a) Ayrshire
  - 1) Red and white
  - 2) Excellent grazers with high quality udders
  - 3) Not used extensively in the dairy industry because of their comparatively low milk production
  - 4) Imported from Scotland in the early nineteenth century
- b) Brown Swiss
  - 1) Light to dark brown with black noses and tongues
  - 2) Large in size
  - 3) Rank second to Holsteins in average pounds of milk produced per animal
  - 4) Heat-tolerant breed often used in tropical areas of the world
  - 5) Used as a dual purpose breed for milk and beef production
  - 6) Imported from Switzerland in 1869
- c) Guernsey
  - 1) Pale yellow and white
  - 2) Golden color to milk due to high levels of beta-carotene, a source of vitamin A
  - 3) Second to Jerseys in the percentage of fat and protein in milk
  - 4) Imported from the Isle of Guernsey in the early 1800s
- d) Holstein
  - 1) Most popular dairy breed
  - 2) Black and white; occasionally red and white
  - 3) Largest of the dairy breeds in size
  - 4) Rank first in the average pounds of milk produced per animal
  - 5) Imported from the Netherlands in the early seventeenth century
- e) Jersey
  - 1) Fawn, light brown, gray, or almost black

- 2) Smallest in size
- 3) Produce milk that has the highest percentage of milk fat and milk protein
- 4) More tolerant of heat stress than Holsteins
- 5) Imported from the Isle of Jersey in the early nineteenth century
- f) Milking Shorthorn
  - 1) Red, white, or any combination of the two
  - 2) Dual purpose breed used for both beef and milk production
  - 3) Recognized as a breed in the 1940s
  - 4) Originated in England

- 2. Ask students to describe how a breed is selected. Make sure students focus on the goals of the individual producer.

**What factors influence breed selection?**

- a) Breed selection depends on the goals of the producer.
- b) The primary goal of most producers is to maximize milk production, which is why Holsteins are the most popular dairy breed.
- c) Other breeds have desirable qualities that the producer may wish to add to his or her herd (e.g., more milk fat and milk protein).

**F. Other Activities**

Have students search the Internet for information on different breeds. Oklahoma State University has a website, located at <http://www.ansi.okstate.edu/breeds>, that covers many breeds of livestock, including dairy cattle.

**G. Conclusion**

The major dairy breeds are the Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and Milking Shorthorn. Most producers seek to maximize milk production when selecting a breed, although a producer may choose another breed to achieve a particular goal.

**H. Answers to Evaluation**

- 1. d
- 2. f
- 3. e
- 4. a
- 5. f
- 6. b
- 7. c
- 8. b
- 9. d

- 10. The primary goal of most producers is to maximize milk production.

UNIT - INTRODUCTION TO DAIRY PRODUCTION

Name \_\_\_\_\_

Lesson 2: Breeds of Dairy Cattle

Date \_\_\_\_\_

EVALUATION

Write the letter of the breed in the right-hand column next to the best description in the left-hand column. Letters may be used more than once.

- |                                                    |                      |
|----------------------------------------------------|----------------------|
| 1. _____ Yellow and white                          | a. Milking Shorthorn |
| 2. _____ Black and white                           | b. Brown Swiss       |
| 3. _____ Highest percentage of milk fat            | c. Ayrshire          |
| 4. _____ Recognized as a breed in the 1940s        | d. Guernsey          |
| 5. _____ Ranked first in pounds of milk per animal | e. Jersey            |
| 6. _____ Imported from Switzerland                 | f. Holstein          |
| 7. _____ Imported from Scotland                    |                      |
| 8. _____ Black noses and tongues                   |                      |
| 9. _____ Golden color to milk                      |                      |

Complete the following short answer question.

10. What is the primary goal of most dairy producers?

## Dairy Breeds

| Breed Name        | Color | When Imported | Origin | Notable Characteristics |
|-------------------|-------|---------------|--------|-------------------------|
| Ayrshire          |       |               |        |                         |
| Brown Swiss       |       |               |        |                         |
| Guernsey          |       |               |        |                         |
| Holstein          |       |               |        |                         |
| Jersey            |       |               |        |                         |
| Milking Shorthorn |       |               |        |                         |

15

## Lesson 2: Breeds of Dairy Cattle

Name \_\_\_\_\_

**Dairy Breeds****Objective:** Identify the distinguishing characteristics of the six major dairy breeds.**Fill in the table with information about each of the dairy cattle breeds listed.**

| Breed Name        | Color | When Imported | Origin | Notable Characteristics |
|-------------------|-------|---------------|--------|-------------------------|
| Ayrshire          |       |               |        |                         |
| Brown Swiss       |       |               |        |                         |
| Guernsey          |       |               |        |                         |
| Holstein          |       |               |        |                         |
| Jersey            |       |               |        |                         |
| Milking Shorthorn |       |               |        |                         |

**Researching Dairy Breeds**

**Objective:** Become familiar with the various breeds of dairy cattle.

**Obtain** the address of one of the dairy breed associations from your instructor. Write a letter to the association requesting information, pictures, videos, etc., for that breed.

**When you receive the material from the breed association, prepare a report for the class. Your report should answer the following questions.**

- What is the official name of the breed association?
- What is the history of the breed?
- When was the breed association formed?
- What are the standards for registration?
- What characteristics would disqualify an animal for registration?
- What are the important traits of the breed?

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 3: Principles of Dairy Cattle Selection

Competency/Objective: Use available information to select dairy cattle.

#### Study Questions

1. What are the parts of the dairy cow?
2. How is the Dairy Cow Unified Score Card used in the classification of dairy cattle?
3. How is linear evaluation used in dairy herd improvement?

#### References

1. *Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
2. Transparency Masters
  - a) TM 3.1a: Parts of a Dairy Cow
  - b) TM 3.1b: Parts of a Dairy Cow (Overlay)
  - c) TM 3.2: Dairy Cow Unified Score Card
3. Activity Sheets
  - a) AS 3.1: Parts of a Dairy Cow
  - b) AS 3.2: Linear Evaluation

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 3: Principles of Dairy Cattle Selection

#### TEACHING PROCEDURES

##### A. Review

Lesson 2 described the major dairy breeds, including the origins and special characteristics of each breed. After selecting a particular breed, the producer must evaluate individual animals for production and breeding purposes. The Dairy Cow Unified Score Card and linear evaluation provide two ways to evaluate dairy cows.

##### B. Motivation

Show the students pictures of several dairy cows. Have them try to classify the cows by their visible traits.

##### C. Assignment

##### D. Supervised Study

##### E. Discussion

1. Explain to students the importance of using proper terminology when describing dairy cattle. Use TM 3.1a and 3.1b to illustrate the parts of the dairy cow. Have students complete AS 3.1.

#### What are the parts of the dairy cow?

- a) Face
- b) Muzzle
- c) Jaw
- d) Neck
- e) Throat
- f) Dewlap
- g) Brisket
- h) Floor of the chest
- i) Barrel
- j) Milk wells
- k) Mammary veins
- l) Fore udder attachment
- m) Ribs
- n) Teat
- o) Pastern
- p) Hoof
- q) Dewclaw
- r) Switch
- s) Hock
- t) Rear flank
- u) Thigh
- v) Rear udder attachment
- w) Tail
- x) Pin bones
- y) Tail head
- z) Thurl
- aa) Hooks

- bb) Withers
- cc) Heart girth
- dd) Poll
- ee) Rump
- ff) Loin
- gg) Chine
- hh) Back

2. Begin a discussion by passing out a copy of the current Dairy Cow Unified Score Card as found in the contest bulletin. Using TM 3.2, ask for input on the various parts of the card.

**How is the Dairy Cow Unified Score Card used in classification of dairy cattle?**

- a) Cows are compared to an ideal cow (which is assigned a score of 100 points) and classified according to their scores.
    - 1) Excellent - 90-100 points
    - 2) Very Good - 85-89 points
    - 3) Good Plus - 80-84 points
    - 4) Good - 75-79 points
    - 5) Fair - 70-74 points
    - 6) Poor - less than 70 points
  - b) The score card looks at five major traits.
    - 1) Frame - evaluation of the skeletal parts of the cow except the feet and legs
    - 2) Dairy character - evaluation of milking ability
    - 3) Body capacity - evaluation of the volume of the cow
    - 4) Feet and legs - evaluation of the cow's skeletal soundness, or ability to move easily
    - 5) Udder
      - (a) Most important part of the dairy cow
      - (b) Evaluation for milk production and productivity over time
3. Ask the class what linear evaluation is. List the seventeen functional traits on the board or overhead. Discuss how producers can select to improve specific traits using linear evaluation. For a more detailed reference on linear evaluation, consult the Holstein Association's *Linear Classification System*.

**How is linear evaluation used in dairy herd improvement?**

- a) In linear evaluation, a computer program is used to score cattle for individual traits; producers use this information to improve the functional type of the dairy herd by selecting animals for breeding.
- b) Seventeen linear traits are used in evaluating cows, with traits assigned a numerical score between one and fifty.
  - 1) Stature
  - 2) Strength
  - 3) Body depth
  - 4) Dairy form
  - 5) Rump angle
  - 6) Rump width
  - 7) Rear legs (side view)
  - 8) Foot angle
  - 9) Fore udder attachment
  - 10) Rear udder height
  - 11) Rear udder width
  - 12) Udder cleft
  - 13) Udder depth
  - 14) Front teat placement

- 15) Teat length
- 16) Rear legs (rear view)
- 17) Udder tilt
- c) Producers can pinpoint specific traits in cows that should be improved and then select bulls for breeding.
- d) They can also evaluate and select bulls for breeding by using their daughters' scores.

#### F. Other Activities

1. Obtain a video on evaluating dairy cattle, such as "Judging Dairy Cows" (28 min.), from Creative Educational Video (CEV). Have students practice judging dairy cattle.
2. Visit a local producer, and discuss selection and linear evaluation.

#### G. Conclusion

Dairy producers need to be aware of the parts of a dairy cow and how to evaluate and select dairy animals. The Dairy Cow Unified Score Card provides a basis for evaluation. Linear evaluation is often used when selecting animals for breeding.

#### H. Answers to Activity Sheet

##### AS 3.1

- |                           |                           |
|---------------------------|---------------------------|
| 1. Face                   | 18. Switch                |
| 2. Muzzle                 | 19. Hock                  |
| 3. Jaw                    | 20. Rear flank            |
| 4. Neck                   | 21. Thigh                 |
| 5. Throat                 | 22. Rear udder attachment |
| 6. Dewlap                 | 23. Tail                  |
| 7. Brisket                | 24. Pin bones             |
| 8. Floor of the chest     | 25. Tail head             |
| 9. Barrel                 | 26. Thurl                 |
| 10. Milk wells            | 27. Hooks                 |
| 11. Mammary veins         | 28. Withers               |
| 12. Fore udder attachment | 29. Heart girth           |
| 13. Ribs                  | 30. Poll                  |
| 14. Teat                  | 31. Rump                  |
| 15. Pastern               | 32. Loin                  |
| 16. Hoof                  | 33. Chine                 |
| 17. Dewclaw               | 34. Back                  |

##### AS 3.2

1. The cow is fine for fifteen of the seventeen traits. However, udder depth (UD) is too low and teat placement (TP) is too wide. When the cow is mated, the producer should pay particular attention to udder depth and teat placement.
2. Cow 2 has problems with stature (ST), rump angle (RA), and udder cleft (UC). The cow is small, and its rump has a severe slope from hooks to pins. The cow also has little, if any, cleft in her udder. The producer should select for these traits when mating the cow.

#### I. Answers to Evaluation

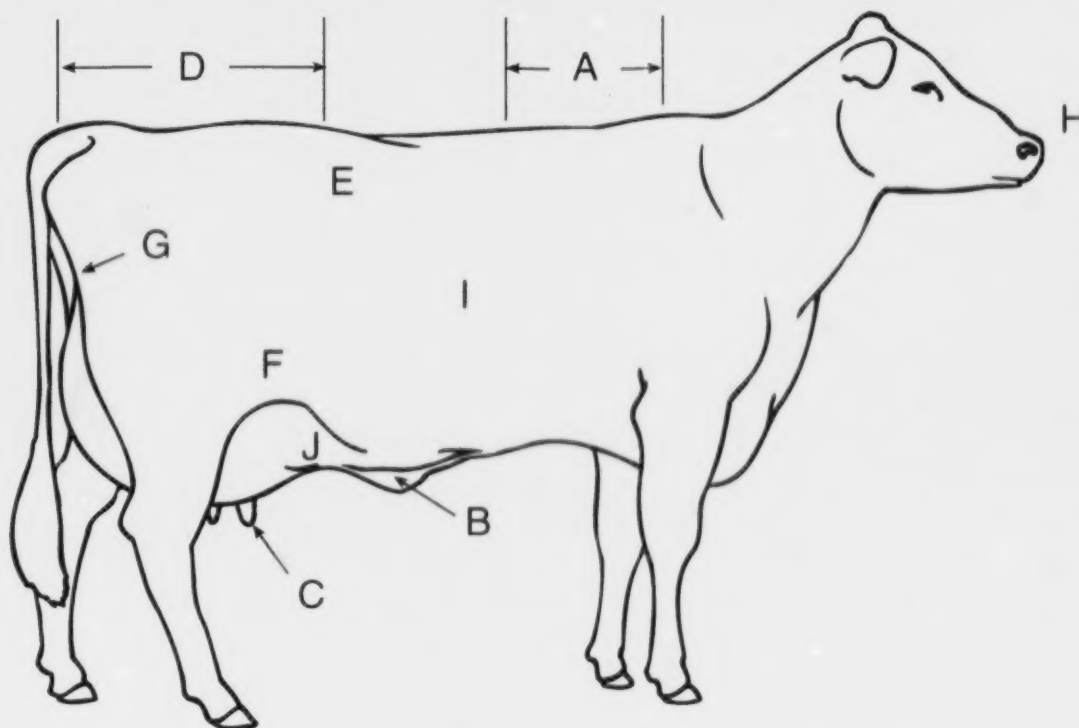
1. b
2. g

- 3. d
- 4. c
- 5. i
- 6. e
- 7. f
- 8. j
- 9. h
- 10. a
- 11. c
- 12. d
- 13. b

- 14. Answers may include any three of the following: stature, strength, body depth, dairy form, rump angle, rump width, rear legs (side view), foot angle, fore udder attachment, rear udder height, rear udder width, udder cleft, udder depth, front teat placement, teat length, rear legs (rear view), or udder tilt.
- 15. Producers use the information from linear evaluation to improve the functional type of the dairy herd by selecting animals for breeding.

## EVALUATION

Write the letter from the diagram in the blank next to the name of that part of the cow.



1. \_\_\_\_\_ Milk wells
2. \_\_\_\_\_ Rear udder attachment
3. \_\_\_\_\_ Rump
4. \_\_\_\_\_ Teat
5. \_\_\_\_\_ Barrel
6. \_\_\_\_\_ Hooks
7. \_\_\_\_\_ Rear flank
8. \_\_\_\_\_ Fore udder attachment
9. \_\_\_\_\_ Muzzle
10. \_\_\_\_\_ Chine

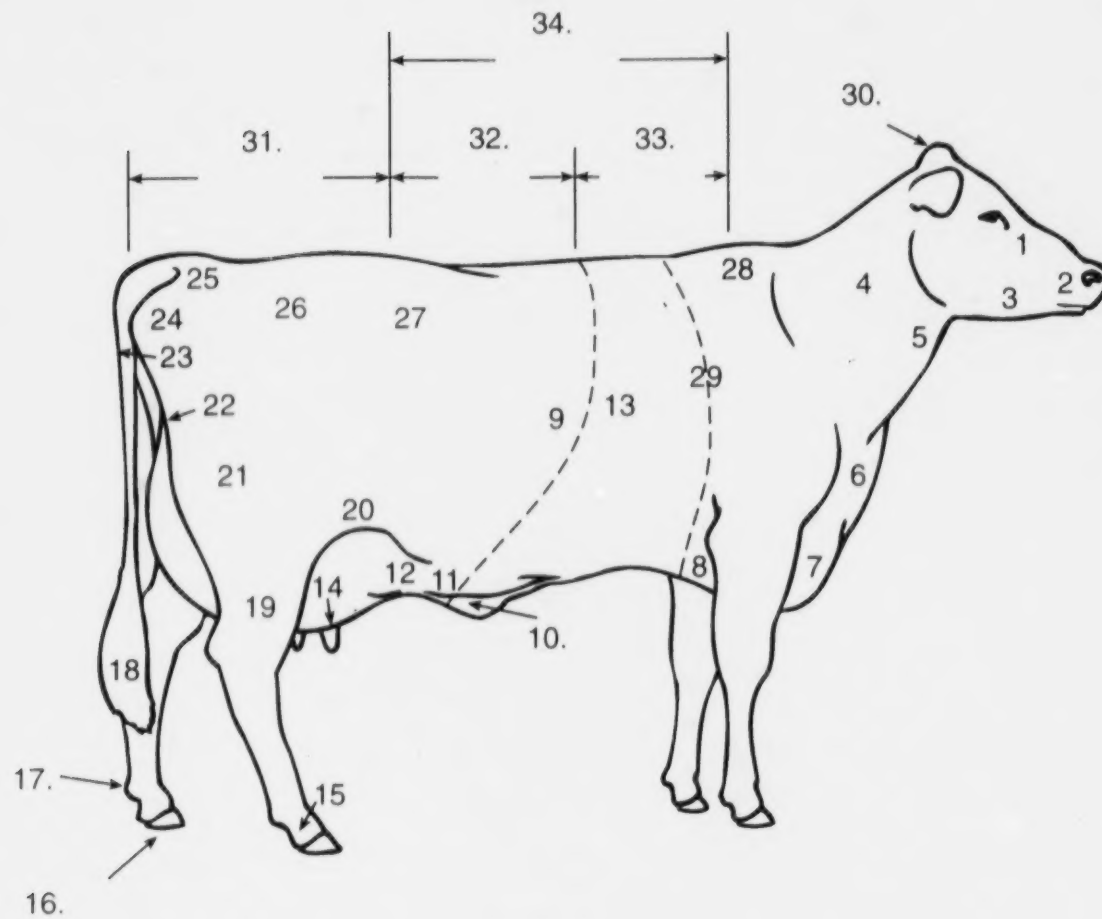
**Circle the letter that corresponds with the best answer.**

11. Which of the traits on the Dairy Cow Unified Score Card is the most important for evaluation?
- a. Frame
  - b. Body capacity
  - c. Udder
  - d. Feet and legs
12. How many individual traits does linear classification take into account?
- a. 14
  - b. 15
  - c. 16
  - d. 17
13. On the Dairy Cow Unified Score Card, "dairy character" is an evaluation of:
- a. Volume
  - b. Milking ability
  - c. Ability to move easily
  - d. Productivity over time

**Complete the following short answer questions.**

14. What are three of the linear traits used in evaluation?
- a.
  - b.
  - c.
15. How do producers use linear evaluation?

# Parts of a Dairy Cow



TM 3.1a

## Parts of a Dairy Cow (Overlay)

27. Hooks  
 26. Thurl  
 25. Tail head  
 24. Pin bones  
 23. Tail  
 22. Rear udder attachment  
 21. Thigh  
 20. Rear flank  
 19. Hock  
 18. Switch  
 Dewclaw  
 Hoof  
 15. Pastern  
 14. Teat  
 13. Ribs  
 11. Mammary veins  
 12. Fore udder attachment  
 10. Milk wells  
 9. Barrel  
 8. Floor of the chest  
 7. Brisket  
 6. Dewlap  
 5. Throat  
 4. Neck  
 3. Jaw  
 2. Muzzle  
 1. Face  
 Poll  
 29. Heart Girth  
 28. Withers  
 Back  
 Rump  
 Loin  
 Chine

31

# DAIRY COW UNIFIED SCORE CARD

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Breed characteristics should be considered in the application of this score card

## MAJOR TRAIT DESCRIPTIONS

There are five major classification traits on which a classifier bases a cow's score. Each trait is broken down into body parts to be looked at and ranked.

### 1) Frame - 15%

The skeletal parts of the cow, with the exception of feet and legs, are evaluated. Listed in priority order, the descriptions of the traits to be considered are as follows:

**Rump** - long and wide throughout with pin bones slightly lower than hip bones. Thurls need to be wide apart and centrally placed between hip bones and pin bones. The tailhead is set slightly above and neatly between pin bones, and the tail is free from coarseness. The vulva is nearly vertical. **Stature** - height, including length in the leg bones. A long bone pattern throughout the body structure is desirable. Height at the withers and hips should be relatively proportionate. **Front End** - adequate constitution with front legs straight, wide apart and squarely placed. Shoulder blades and elbows need to be firmly set against the chest wall. The crops should have adequate fullness. **Back** - straight and strong, the loin - broad, strong, and nearly level. **Breed Characteristics** - overall style and balance. Head should be feminine, clean-cut, slightly dished with broad muzzle, large open nostrils and a strong jaw is desirable.

Rump, Stature, and Front End receive primary consideration when evaluating Frame.

### 2) Dairy Character - 20%

The physical evidence of milking ability is evaluated. Major consideration is given to general openness and angularity while maintaining strength, flatness of bone and freedom from coarseness. Consideration is given to stage of lactation. Listed in priority order, the descriptions of the traits to be considered are as follows:

**Ribs** - wide apart. Rib bones are wide, flat, deep, and slanted toward the rear. **Thighs** - lean, incurving to flat, and wide apart from the rear. **Withers** - sharp with the chine prominent. **Neck** - long, lean, and blending smoothly into shoulders. A clean-cut throat, dewlap, and brisket are desirable. **Skin** - thin, loose, and pliable.

### 3) Body Capacity - 10%

The volumetric measurement of the capacity of the cow (length x depth x width) is evaluated with age taken into consideration. Listed in priority order the descriptions of the traits to be considered are as follows:

**Barrel** - long, deep, and wide. Depth and spring of rib increase toward the rear with a deep flank. **Chest** - deep and wide floor with well-sprung fore ribs blending into the shoulders.

The Barrel receives primary consideration when evaluating Body Capacity.

### 4) Feet and Legs - 15%

Feet and rear legs are evaluated. Evidence of mobility is given major consideration. Listed in priority order, the descriptions of the traits to be considered are as follows:

**Feet** - steep angle and deep heel with short, well-rounded closed toes. **Rear Legs - Rear View** - straight, wide apart with feet squarely placed. **Side View** - a moderate set (angle) to the hock. **Hocks** - cleanly molded, free from coarseness and puffiness with adequate flexibility. **Pasterns** - short and strong with some flexibility.

Slightly more emphasis placed on Feet than on Rear Legs when evaluating this breakdown.

### 5) Udder - 40%

The udder traits are the most heavily weighted. Major consideration is given to the traits that contribute to high milk yield and a long productive life. Listed in priority order, the descriptions of the traits to be considered are as follows:

**Udder Depth** - moderate depth relative to the hock with adequate capacity and clearance. Consideration is given to lactation number and age.

**Teat Placement** - squarely placed under each quarter, plumb and properly spaced from side and rear views.

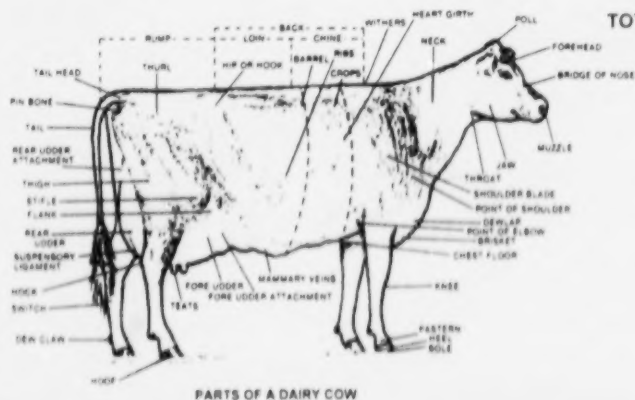
**Rear Udder** - wide and high, firmly attached with uniform width from top to bottom and slightly rounded to udder floor.

**Udder Cleft** - evidence of a strong suspensory ligament indicated by adequately defined halving.

**Fore Udder** - firmly attached with moderate length and ample capacity.

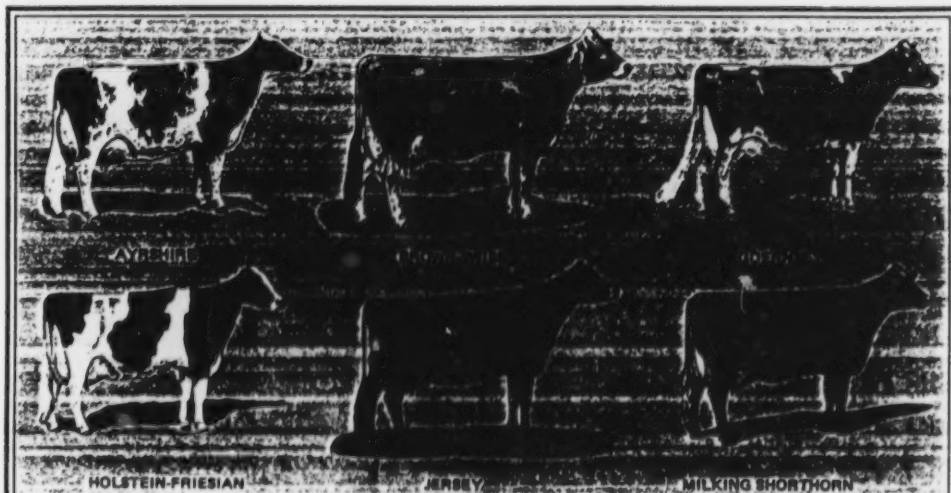
**Teats** - cylindrical shape and uniform size with medium length and diameter.

**Udder Balance and Texture** - should exhibit an udder floor that is level as viewed from the side. Quarters should be evenly balanced, soft, pliable and well collapsed after milking.



PARTS OF A DAIRY COW

TOTAL 100



### BREED CHARACTERISTICS

Except for differences in color, size and head character, all breeds are judged on the same standards as outlined in the Unified Score Card. If any animal is registered by one of the dairy breed associations, no discrimination against color or color pattern is to be made.

#### AYRSHIRE

Strong and robust, showing constitution and vigor, symmetry, style and balance throughout, and characterized by strongly attached, evenly balanced, well-shaped udder.

**HEAD**-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dished; bridge of nose straight; ears medium size and alertly carried.

**COLOR**-light to deep cherry red, mahogany, brown, or a combination of any of these colors with white, or white alone, distinctive red and white markings preferred.

**SIZE**-a mature cow in milk should weigh at least 1200 lbs.

#### HOLSTEIN

Rugged, feminine qualities in an alert cow possessing Holstein size and vigor.

**HEAD**-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dished; bridge of nose straight; ears medium size and alertly carried.

**COLOR**-black and white or red and white markings clearly defined.

**SIZE**-a mature cow in milk should weigh a minimum of 1500 lbs.

#### MILKING SHORTHORN

Strong and vigorous, but not coarse.

**HEAD**-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dished; bridge of nose straight; ears, medium size and alertly carried.

**COLOR**-red or white or any combination. (No black markings allowed).

**SIZE**-a mature cow should weigh 1400 lbs.

#### BROWN SWISS

Strong and vigorous, but not coarse. Size and ruggedness with quality desired. Extreme refinement undesirable.

**HEAD**-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and slightly dished; bridge of nose straight; ears medium size and alertly carried.

**COLOR**-solid brown varying from very light to dark. Muzzle is black encircled by a mealy colored ring, and the tongue, switch and hooves are black.

**SIZE**-a mature cow in milk should weigh 1500 lbs.

#### GUERNSEY

Size and strength, with quality and character desired.

**HEAD**-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and slightly dished; bridge of nose straight; ears medium size and alertly carried.

**COLOR**-a shade of fawn with white markings throughout clearly defined. When other points are equal, clear (buff) muzzle will be favored over a smoky or black muzzle.

**SIZE**-a mature cow in milk should weigh at least 1150 lbs.

#### JERSEY

Sharpness with strength indicating productive efficiency.

**HEAD**-proportionate to stature showing refinement and well chiseled bone structure. Face slightly dished with dark eyes that are well set.

**COLOR**-some shade of fawn with or without white markings. Muzzle is black encircled by a light colored ring, and the tongue and switch may be either white or black.

**SIZE**-a mature cow in milk should weigh about 900 lbs.

### FACTORS TO BE EVALUATED

The degree of discrimination assigned to each defect is related to its function and heredity. The evaluation of the defect shall be determined by the breeder, the classifier or the judge, based on the guide for discrimination and disqualifications given below.

#### HORNS

No discrimination for horns.

#### EYES

- 1 Blindness in one eye. Slight discrimination.
- 2 Cross or bulging eyes. Slight discrimination.
- 3 Evidence of blindness. Slight to serious discrimination.
- 4 Total blindness. Disqualification.

#### WRY FACE

Slight to serious discrimination.

#### CROPPED EARS

Slight discrimination.

#### PARROT JAW

Slight to serious discrimination.

#### SHOULDERS

Winged. Slight to serious discrimination.

#### TAIL SETTING

Wry tail or other abnormal tail settings.

Slight to serious discrimination.

#### CAPPED HIP

No discrimination unless effects mobility.

#### LEGS AND FEET

- 1 Lameness - apparently permanent and interfering with normal function. Disqualification.
- 2 Lameness - apparently temporary and not affecting normal function. Slight discrimination.
- 2 Evidence of crampy hind legs. Serious discrimination.
- 3 Evidence of fluid in hocks. Slight discrimination.
- 4 Weak pastern. Slight to serious discrimination.
- 5 Toe out. Slight discrimination.

#### UDDER

- 1 Lack of defined udder. Slight to serious discrimination.
- 2 Udder definitely broken away in attachment. Serious discrimination.
- 3 A weak udder attachment. Slight to serious discrimination.
- 4 Blind quarter. Disqualification.
- 5 One or more light quarters, hard spots in udder, obstruction in teat (spider). Slight to serious discrimination.

#### 8 Side leak. Slight discrimination.

- 7 Abnormal milk (bloody, clotted, watery). Possible discrimination.

#### LACK OF SIZE

Slight to serious discrimination.

#### EVIDENCE OF SHARP PRACTICE

(Refer to PDCA Code of Ethics)

- 1 Animals showing signs of having been tampered with to conceal faults in conformation and to misrepresent the animal's soundness. Disqualification.
- 2 Uncared heifers showing evidence of having been milked. Slight to serious discrimination.

#### TEMPORARY OR MINOR INJURIES

Blemishes or injuries of a temporary character not affecting animal's usefulness. Slight to serious discrimination.

#### OVERCONDITIONED

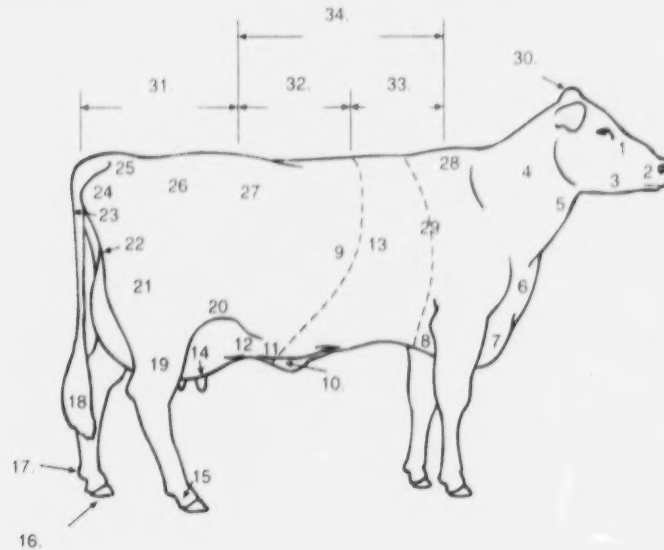
Slight to serious discrimination.

#### FREEMARTIN HEIFERS

Disqualification.

## Lesson 3: Principles of Dairy Cattle Selection

Name \_\_\_\_\_

**Parts of a Dairy Cow****Objective:** Identify the parts of a dairy cow.**Write the names of the parts of a dairy cow in the numbered blanks.**

- |           |           |           |
|-----------|-----------|-----------|
| 1. _____  | 13. _____ | 25. _____ |
| 2. _____  | 14. _____ | 26. _____ |
| 3. _____  | 15. _____ | 27. _____ |
| 4. _____  | 16. _____ | 28. _____ |
| 5. _____  | 17. _____ | 29. _____ |
| 6. _____  | 18. _____ | 30. _____ |
| 7. _____  | 19. _____ | 31. _____ |
| 8. _____  | 20. _____ | 32. _____ |
| 9. _____  | 21. _____ | 33. _____ |
| 10. _____ | 22. _____ | 34. _____ |
| 11. _____ | 23. _____ |           |
| 12. _____ | 24. _____ |           |

## Lesson 3: Principles of Dairy Cattle Selection

Name \_\_\_\_\_

## Linear Evaluation

**Objective:** Use linear evaluation to evaluate cows.

Looking at the linear traits described below, evaluate the cows by looking at the scores they have received for the seventeen traits. Describe the problems with each cow that could be selected for improvement. The cow's scores for a particular trait should be within five points of the ideal score.

## Linear Traits

\*most desirable score

|                            |                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------|
| Stature (ST)               | 1-5 Extremely short<br>25 Intermediate<br>45-50 Extremely tall*                                                        |
| Strength (SR)              | 1-5 Extremely narrow and frail<br>25 Intermediate<br>45-50 Extremely strong and wide*                                  |
| Body Depth (BD)            | 1-5 Extremely shallow body<br>25 Intermediate<br>45-50 Extremely deep body*                                            |
| Dairy Form (DF)            | 1-5 Extremely tight<br>25 Intermediate*<br>45-50 Extremely open                                                        |
| Rump Angle (RA)            | 1-5 Pins clearly higher than hooks<br>25 Slight slope from hooks to pins*<br>45-50 Extremely sloped from hooks to pins |
| Rump Width (RW)            | 1 Extremely narrow<br>25 Intermediate<br>50 Extremely wide*                                                            |
| Rear Legs - side view (LS) | 1-5 Posty and straight<br>25 Intermediate set*<br>45-50 Extremely sickled                                              |
| Foot Angle (FA)            | 1-5 Extremely low angle<br>25 Intermediate*<br>45-50 Extremely steep                                                   |
| Fore Udder Attachment (FU) | 1-5 Extremely loose<br>25 Intermediate strength<br>45-50 Extremely snug and strong*                                    |
| Rear Udder Height (UH)     | 1-5 Extremely low<br>25 Intermediate height<br>45-50 Extremely high*                                                   |

|                            |                                                                                                                |
|----------------------------|----------------------------------------------------------------------------------------------------------------|
| Rear Udder Width (UW)      | 1-5 Narrow rear udder<br>25 Intermediate<br>45-50 Extremely wide rear udder*                                   |
| Udder Cleft (UC)           | 1-5 Weak cleft<br>25 Intermediate<br>45-50 Extremely strong cleft*                                             |
| Udder Depth (UD)           | 1-5 Very deep udder floor below hocks<br>25 Intermediate*<br>45-50 Extremely high                              |
| Front Teat Placement (TP)  | 1-5 Extremely wide on outside of quarters<br>25 Centrally placed*<br>45-50 Base of teats on inside of quarters |
| Teat Length (TL)           | 1-5 1-1/4 inches or smaller<br>25 2-1/4 inches*<br>45-50 3-1/4 inches or longer                                |
| Rear Legs - rear view (RL) | 1-5 Severe toe out<br>45-50 No toe out*                                                                        |
| Udder Tilt (UT)            | 1-5 Rear quarters deep<br>25 Front and rear quarters level*<br>45-50 Front quarters deep                       |

1. Cow 1

|    |    |    |    |
|----|----|----|----|
| ST | 46 | UH | 43 |
| SR | 43 | UW | 45 |
| BD | 49 | UC | 46 |
| DF | 22 | UD | 15 |
| RA | 29 | TP | 7  |
| RW | 48 | TL | 27 |
| LS | 21 | RL | 46 |
| FA | 22 | UT | 30 |
| FU | 47 |    |    |

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2. Cow 2

|    |    |
|----|----|
| ST | 25 |
| SR | 46 |
| BD | 44 |
| DF | 25 |
| RA | 43 |
| RW | 48 |
| LS | 25 |
| FA | 25 |
| FU | 43 |

|    |    |
|----|----|
| UH | 45 |
| UW | 45 |
| UC | 1  |
| UD | 25 |
| TP | 25 |
| TL | 25 |
| RL | 48 |
| UT | 30 |

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## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 4: Herd Management

Competency/Objective: List management factors important to profitable dairy production.

#### Study Questions

1. What are the production costs for operating a dairy?
2. What are the facility requirements for dairy production?
3. What factors must be considered in raising replacement heifers?
4. What are the factors to consider in reproductive management?
5. What are the nutritional requirements for dairy cattle?
6. What are feeding methods for dairy cattle?
7. What records must be kept for profitable dairy production?
8. What are the factors involved in marketing dairy products?

#### References

1. *Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
2. Transparency Master
  - a) TM 4.1: Lactation Curve of the Dairy Cow
3. Activity Sheet
  - a) AS 4.1: Costs and Returns

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 4: Herd Management

#### TEACHING PROCEDURES

##### A. Review

Lesson 3 discussed the principles of dairy cattle selection. Lesson 4 focuses on the management of the herd for dairy production. Production costs, facility requirements, raising replacement heifers, reproductive management, nutritional requirements, record keeping, and marketing will be discussed.

##### B. Motivation

Bring an empty gallon milk jug and ask the class how much the milk would cost in the store (\$2.30 to \$2.70). Compare that price to how much the dairy producer makes per gallon. (Contact the local milk marketing cooperative or extension office for current milk prices.) Ask students to list facilities, equipment, and other requirements for a dairy farm. Discuss how much these things cost. Compare the cost of dairy production to the returns from milk sales.

##### C. Assignment

##### D. Supervised Study

##### E. Discussion

1. Ask students to list production costs for a dairy operation. Write the list on the board or overhead. MU Guide Sheet G3651 can be used as a specific reference for a dairy cattle budget. Have students complete the budget in AS 4.1.

#### **What are the production costs for operating a dairy?**

- a) Facilities
  - b) Feed - major cost on a daily basis
  - c) Labor
  - d) Marketing fees
  - e) Fees for milk testing
  - f) Veterinary fees and medicine
  - g) Building repair and maintenance
2. Ask the class to list the facility requirements for a dairy operation. Write down the responses and then elaborate on each response. Remind students that dairy production may take place in a large-scale, labor-intensive environment.

#### **What are the facility requirements for dairy production?**

- a) Milking parlor
  - 1) Milking parlors are required for modern dairies that produce Grade A milk.
  - 2) Designs
    - (a) Parallel
      - (1) Cows stand at a 90° angle on both sides of a pit where the milkers stand.
      - (2) The milking unit is attached between the hind legs.
    - (b) Herringbone
      - (1) Cows stand at an angle on both sides of a pit.

- (2) The design allows easy access to each cow's udder from the side for putting on and removing the milking units.
  - b) Free stall or stanchion barns
    - 1) In free stall barns, cows move freely between the separate stalls.
    - 2) In stanchion barns, a headgate or a chain and collar confines cows to their stalls.
  - c) Feed storage
    - 1) Upright silos and pit silos hold corn silage and haylage.
    - 2) Grain and bulk bins hold prepared feed or supplements.
  - d) Waste storage
    - 1) Lagoons are artificial waste holding areas that resemble ponds.
    - 2) A watertight concrete or coated steel tank may also be used for manure storage; tanks may be above or below ground.
  - e) Heifer development facilities
    - 1) Calves are kept individually in hutches until weaning.
    - 2) They are then moved to group pens.
3. Ask students what should be considered when raising replacement heifers. For specific feeding programs, consult National Research Council (NRC) recommendations.

**What factors must be considered in raising replacement heifers?**

- a) Dairy producers should consider the number of females needed each year as well as proper development.
  - b) Heifers should be ready to calve at 24 months of age and weigh 1,000 to 1,300 pounds, depending on the breed.
  - c) Careful feeding is essential if heifers are to reach this weight at the right time for breeding.
    - 1) Small, thin heifers give less milk.
    - 2) Heifers should not be allowed to become too fat, since excessive fat deposits in the udder may reduce future milk production.
4. Ask the class what factors dairy producers must take into account when managing the reproductive aspect of dairy farming. Use TM 4.1 to illustrate the lactation curve.

**What are the factors to consider in reproductive management?**

- a) Cows must become pregnant and calve for lactation to begin.
  - b) Lactation usually peaks at eight weeks after calving and then slowly declines.
  - c) Cows should be rebred 40 to 100 days after calving to maintain the cycle of milk production.
  - d) Cows are dried off at 40 to 50 weeks of lactation, depending on the amount of milk produced and the expected calving date; most operators will dry off cows when milk production drops below 35 to 40 pounds daily.
  - e) The dry period should last 40 to 70 days, with an average of 60 days.
  - f) Most dairy cows are artificially inseminated.
    - 1) Permits the dairy producer to use bulls that are genetically superior
    - 2) Helps in controlling the spread of reproductive diseases
    - 3) Allows producers to keep more accurate records about reproduction, including breeding dates that can be used to calculate the expected calving dates needed to figure the proper dry period
    - 4) Also used because of the problems associated with keeping a dairy bull on the farm, since dairy bulls are often very aggressive
  - g) Some producers use embryo transfer to increase the spread of superior genetics in the herd.
5. List the various components of proper nutrition necessary for dairy cattle rations. Ask the class how to determine the nutritional requirements for dairy cattle. Obtain copies of NRC requirements for dairy cattle diets if students are interested in specific feeding programs.

**What are the nutritional requirements for dairy cattle?**

- a) Nutritional requirements include energy (from carbohydrates and fats), protein, vitamins, minerals, and water.
  - b) The cow's nutritional needs are highest when lactation peaks.
  - c) Lactating cows consume 3 to 4 percent of their body weight as dry matter.
  - d) Roughages should make up at least 40 percent of the diet to maintain correct microbe populations in the rumen.
  - e) The cow's production level and body condition determine the exact nutrient needs of the cow.
6. Discuss the different feeding methods that can be used to meet the nutritional needs of dairy cows.

**What are feeding methods for dairy cattle?**

- a) Traditional feeding method
    - 1) This method involves feeding forages and grain separately.
    - 2) Forages may be fed as pasture or as hay or silage.
    - 3) Protein supplements, or concentrates, are added to the diet to increase the amount of protein; they may be fed in the barn mangers or in the milking parlor during milking.
  - b) Management-intensive grazing
    - 1) Producers rotate cows between grazing units in a preplanned cycle.
    - 2) Cows are moved when they consume the forages on the grazing unit.
    - 3) This type of grazing system helps lower costs by reducing the costs associated with equipment for harvesting forages and purchased feeds.
  - c) Total mixed ration
    - 1) A total mixed ration is a mixture of all the feed ingredients needed by dairy cattle, including forages, grain, and supplements.
    - 2) Advantages include being able to feed a precisely balanced ration and reduced labor.
    - 3) Special equipment for weighing and mixing the ration must be purchased.
    - 4) Existing facilities may also need to be modified to feed total mixed rations.
7. Ask students what records should be kept for the dairy operation to run smoothly.

**What records must be kept for profitable dairy management?**

- a) Dairy Herd Improvement Association (DHIA) records - contain information on milk production levels and milk composition for individual cows
  - b) Breeding and calving dates
  - c) Calving dates and pedigrees for registered animals
8. Ask the class how milk is marketed in the United States. Explain the role that the United States government plays in controlling the price of fluid milk.

**What are the factors involved in marketing dairy products?**

- a) Most of the milk is sold through cooperatives; producers are members of the cooperative, and they sell directly to it.
- b) The federal government sets base milk prices paid to producers to maintain a steady consumer milk price.
- c) Producers receive bonuses based on the fat and protein content of their milk and low somatic cell counts.

F. Other Activities

Obtain copies of the latest NRC recommendations for dairy rations, and have students develop feeding programs for dairy cattle.

G. Conclusion

Dairy production is a costly venture. Many production costs are associated with running a dairy operation, including the cost of the extensive facilities needed. Most producers market their milk through cooperatives, but the United States government controls the price of milk. Dairy producers need to be good managers to have a profitable operation.

H. Answers to Activity Sheet

AS 4.1

1. (a) 175,500  
(b) 1,755
2. \$14
3. 24,570
4. 2,200
5. 0
6. 26,770
7. (a) 6,000  
(b) 300  
(c) 250  
(d) 0  
(e) 200
8. (a) 19  
(b) \$6  
(c) 114
9. 6,864
10. (a) 1,750  
(b) 290  
(c) \$6  
(d) 1,740  
(e) 1,400  
(f) 80%  
(g) 3,912
11. 1,300
12. 0
13. 150
14. 600
15. 500
16. 100
17. 200
18. 195
19. 625
20. 0
21. 120
22. 20
23. 220
24. 50
25. (a) 1,000  
(b) 50%  
(c) 500

- 26. 400
- 27. 15,756
- 28. 11,014, which is the total profit for the dairy operation

I. Answers to Evaluation

- 1. d
- 2. a
- 3. d
- 4. c
- 5. a
- 6. Eight weeks after calving
- 7. A total mixed ration is a mixture of all the feed ingredients needed by dairy cattle, including forages, grain, and supplements.
- 8. The cow's nutritional needs are highest when lactation peaks.
- 9. Information on production levels and milk composition for each cow
- 10. A management-intensive grazing system helps lower costs by reducing the costs associated with equipment for harvesting forages and purchased feeds.

EVALUATION

Circle the letter that corresponds to the best answer.

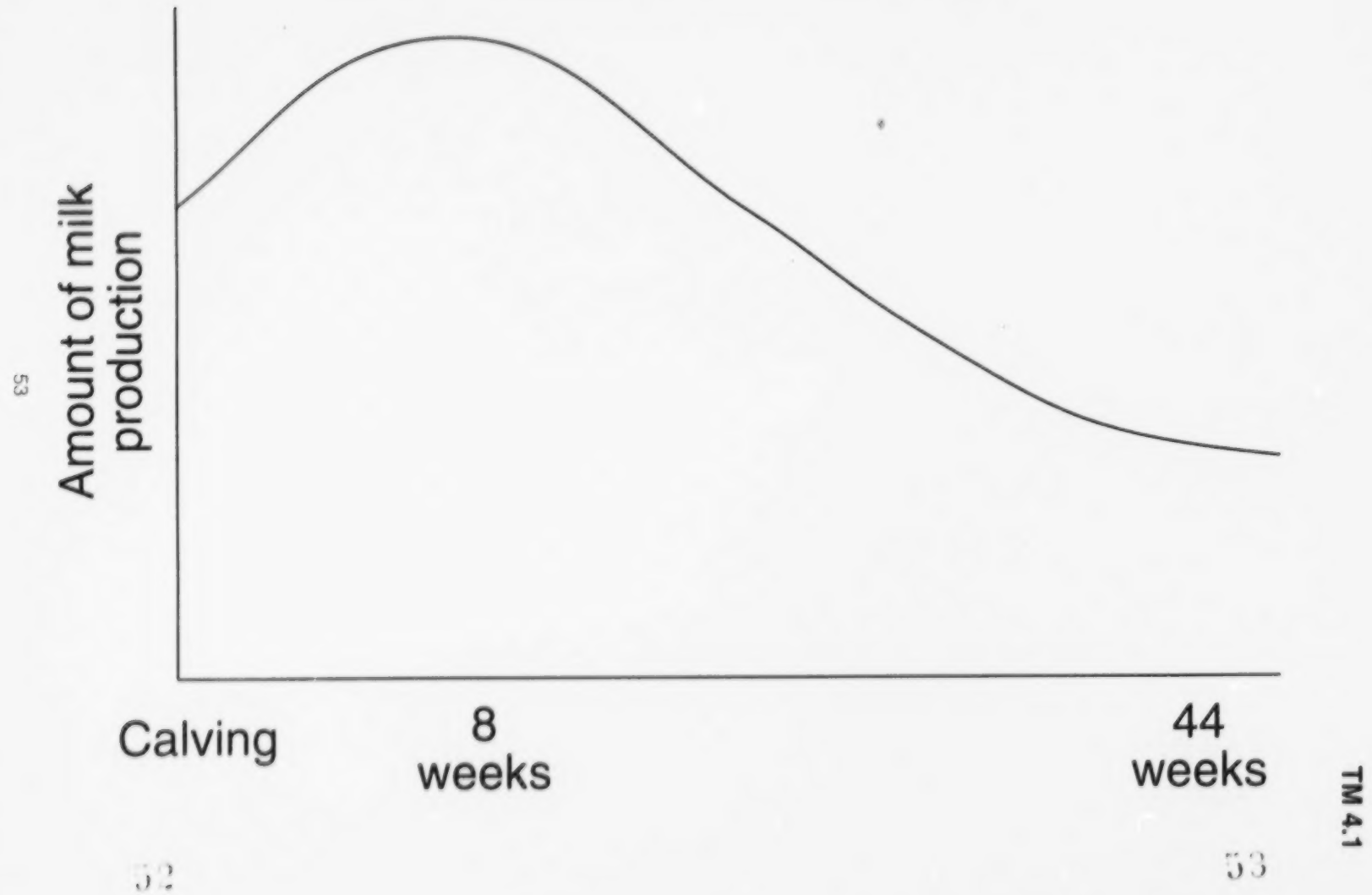
1. Which of the following facilities can have a herringbone design?
  - a. Upright silo
  - b. Stanchion barn
  - c. Free stall barn
  - d. Milking parlor
2. Who sets the base milk price paid to producers?
  - a. Federal government
  - b. Local cooperative
  - c. National dairy producers
  - d. State dairy producers
3. Roughages should make up what percentage of dairy rations?
  - a. 70 percent
  - b. 100 percent
  - c. 10 percent
  - d. 40 percent
4. How old should dairy heifers be when they calve for the first time?
  - a. 36 months
  - b. 20 months
  - c. 24 months
  - d. 30 months
5. What is the major daily cost of cattle production?
  - a. Feed
  - b. Facilities
  - c. Labor
  - d. Marketing fees

Complete the following short answer questions.

6. When does lactation peak in dairy cattle?
7. What is a total mixed ration?

8. When are a cow's nutritional needs the highest?
9. What sort of information does the Dairy Herd Improvement Association record?
10. What is an advantage of using management-intensive grazing in a dairy operation?

## Lactation Curve of the Dairy Cow



## Lesson 4: Herd Management

Name \_\_\_\_\_

**Costs and Returns****Objective:** Prepare a budget for a dairy operation.

Using the information provided, fill out the monthly worksheet for a dairy operation. Determine whether this operation had a profit or loss.

**Returns:**

The operation has sold 175,500 pounds of milk. The price per hundred pounds (cwt) was \$14.00. The producer also received \$2,200 from the sale of heifers.

**Costs:**

The value of the feeds consumed by the herd was \$6,000 for concentrates, \$300 for purchased forages, \$250 for grain produced by the dairy operation, and \$200 for hay. The average number of animals on pasture was 19, with a charge of \$6. Hired labor cost \$1,750. The family put in 290 hours on the operation, at a value of \$6 an hour. Operator labor had a value of \$1,400. Approximately 80% of the hours worked by the work force were spent on the dairy enterprise. Milk check deductions totaled \$1,300, and \$150 was spent on artificial insemination. Veterinary fees and medicine cost \$600. Dairy supplies cost \$500, and fuel cost \$100. Utility bills totaled \$200. Repairs on buildings cost the operation \$195, while machinery repairs totaled \$625. Farm insurance cost \$120, and \$20 was spent on professional fees. Expenses on vehicles totaled \$220. Other expenses cost \$50. Interest payments on the operation totaled \$1,000, 50% of which went for the dairy enterprise. Annual depreciation for the operation is \$4,800.

What is the total profit or loss for this dairy operation? \_\_\_\_\_

## Monthly Worksheet

Name of farm: \_\_\_\_\_ Name of operator: \_\_\_\_\_ Month: \_\_\_\_\_

| Gross income                                                                                    | Your farm | Example farm                 |
|-------------------------------------------------------------------------------------------------|-----------|------------------------------|
| 1. (a) Pounds of milk sold for the month (from your milk check)                                 |           | 181,903                      |
| (b) Divide (a) by 100 to get milk sales in cwt's                                                |           | 1,819                        |
| 2. Gross milk price (\$/cwt)                                                                    |           | \$12.50                      |
| 3. Compute gross milk sales by multiplying 1(b) by step 2                                       |           | 22,738                       |
| 4. Livestock sales related to dairy                                                             |           | 3,000                        |
| 5. Capital revolvments and other dairy income                                                   |           | 0                            |
| 6. Add lines 3, 4 and 5 for total gross receipts                                                |           | 25,738                       |
| <b>Variable expenses</b>                                                                        |           |                              |
| 7. (a) Market value of purchased concentrates, alternative feeds, vitamins and minerals         |           | 6,250                        |
| (b) Market value of purchased forages consumed                                                  |           | 2,873                        |
| (c) Market value of home-raised grains consumed                                                 |           | 667                          |
| (d) Market value of home-raised haylage and silage consumed                                     |           | 0                            |
| (e) Market value of home-raised hay consumed                                                    |           | 0                            |
| 8. Estimate the monthly value of pasture consumed                                               |           |                              |
| (a) Average number of head on pasture for the month                                             |           | 20                           |
| (b) Monthly pasture charge                                                                      |           | \$5                          |
| (c) Multiply (a) by (b)                                                                         |           | 100                          |
| 9. Total 7(a) through 7(e) and 8(c) to compute the total value of feedstuffs consumed           |           | 9,890                        |
| 10. Estimate the true cost of labor for the dairy enterprise                                    |           |                              |
| (a) Amount spent for hired labor for the month (including benefits)                             |           | 2,000                        |
| (b) Hours of unpaid family labor                                                                |           | 330                          |
| (c) Value of family labor                                                                       |           | \$5                          |
| (d) Multiply (b) and (c)                                                                        |           | 1,650                        |
| (e) Value of your operator labor                                                                |           | 200 hrs $\times$ \$8 = 1,600 |
| (f) Portion of time the labor force was used on the dairy enterprise                            |           | 75 %                         |
| (g) Add lines (a), (d) and (e) and multiply by (f)                                              |           | $5,250 \times 75 = 3,938$    |
| 11. Milk check deductions                                                                       |           | 1,764                        |
| 12. Expenses for DHIA fees                                                                      |           | 200                          |
| 13. Expenses for artificial insemination                                                        |           | 283                          |
| 14. Expenses for veterinary fees and medicine                                                   |           | 500                          |
| 15. Expenses for dairy supplies; the portion of the following costs related to the dairy only   |           | 667                          |
| 16. Expenses for fuel and oil                                                                   |           | $3 \times 299 = 90$          |
| 17. Utility bills                                                                               |           | $5 \times 55.8 = 279$        |
| 18. Building repairs                                                                            |           | 208                          |
| 19. Machinery repairs                                                                           |           | $33 \times 1,050 = 347$      |
| 20. Farm taxes                                                                                  |           | 0                            |
| 21. Farm insurance                                                                              |           | $5 \times 300 = 150$         |
| 22. Any legal and professional fees                                                             |           | $5 \times 42 = 21$           |
| 23. Car and truck expenses                                                                      |           | $5 \times 333 = 167$         |
| 24. Other expenses                                                                              |           | 100                          |
| 25. (a) Interest payments                                                                       |           | 1,567                        |
| (b) Portion of the interest payment that went for the dairy enterprise                          |           | 75 %                         |
| (c) Multiply (a) by (b)                                                                         |           | 1,175                        |
| 26. Get estimate for annual depreciation expenses of dairy enterprise. Divide this by figure 12 |           | 642                          |
| 27. Estimate total operating expenses by adding steps 9, 10(g), 11 through 24, 25(c) and 26     |           | 20,419                       |
| 28. Estimate income over operating expenses by subtracting step 27 from step 6                  |           | 5,318                        |

From *How to Compute Your Cost of Producing Milk (G3651)*, University Extension agricultural publications, University of Missouri-Columbia.

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 5: Herd Health

Competency/Objective: Develop a herd health program.

#### Study Questions

1. What are common herd health problems in lactating dairy animals?
2. How is mastitis prevented and controlled?
3. What are common herd health problems in raising replacement heifers?
4. How are medications administered?

#### References

1. *Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
2. Transparency Masters
  - a) TM 5.1: Health Problems in Lactating Dairy Animals
  - b) TM 5.2: Routes of Administration
3. Activity Sheet
  - a) AS 5.1: California Mastitis Test (CMT)

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 5: Herd Health

#### TEACHING PROCEDURES

##### A. Review

Lesson 4 discussed the management factors involved in dairy production. Lesson 5 focuses on herd health issues for dairy cattle and replacement heifers. This lesson will also discuss the proper ways to administer treatments for health problems.

##### B. Motivation

Obtain the paddle and reagent needed to do a California Mastitis Test (CMT), and show them to the class. CMT materials may be purchased from animal health supply warehouses such as Nasco.

##### C. Assignment

##### D. Supervised Study

##### E. Discussion

1. Ask students what the common herd health concerns in lactating dairy cattle are. Use TM 5.1 as a guide for discussion.

#### **What are common herd health problems in lactating dairy animals?**

- a) Milk fever
  - 1) Results from a calcium imbalance and involves abnormally low levels of calcium in the blood
  - 2) Causes loss of appetite, staggering, and paralysis; can cause death if untreated
  - 3) Treated with an intravenous injection of calcium by a veterinarian
  - 4) Prevented by feeding dry cows rations with correct levels of calcium and phosphorus
- b) Ketosis
  - 1) Results from underfeeding during the period of high lactation shortly after calving
  - 2) Causes reduced milk production, weight loss, and a fruity odor to the breath and milk
  - 3) Treated with injections of glucose or hormones
  - 4) Prevented by feeding high energy diets to lactating dairy cattle
- c) Foot rot
  - 1) Caused by a wound between the toes
  - 2) Causes lameness, swelling, fever, decreased appetite, and a sharp decrease in milk production
  - 3) Treated with foot baths and antibiotics
- d) Hairy heel warts
  - 1) Causes an extremely painful growth on the skin on the heels of the rear feet
  - 2) May cause animals to avoid putting weight on their heels; also associated with decreased milk production
  - 3) May be treated with the use of antibiotic sprays on the affected area
- e) Laminitis
  - 1) Caused by high concentrate levels combined with insufficient levels of long fiber from forages for adequate cud chewing, which creates acidic conditions in the rumen
  - 2) Causes lameness and poor milking performance
  - 3) Can be prevented by careful management of feeding; may also require aggressive foot trimming

f) Mastitis

- 1) Causes the greatest economic losses
- 2) Caused by bacteria entering the udder through the teat or an injury to the cow's udder
- 3) Clinical or acute mastitis - causes a severely swollen udder, bloody or clotted milk, loss of appetite, and severe reduction in milk production
- 4) Subclinical or chronic mastitis - causes decreased milk production and an elevated somatic cell count, although the milk appears normal to the herd manager

2. Ask the class to list ways to prevent and control mastitis. Emphasize the fact that mastitis is the single biggest dairy health problem. Have students complete the California Mastitis Test on AS 5.1.

**How is mastitis prevented and controlled?**

a) Prevention

- 1) Proper sanitation
  - (a) Milking equipment must be sanitary to keep cows from being infected by milking units.
  - (b) Before milking, milkers should strip the teats, removing a small amount of milk that is higher in bacteria.
  - (c) They should then wash and dry the teats before attaching the milking units.
  - (d) After milking, they should dip the teats in an acceptable disinfectant.
  - (e) Milkers may also pre-dip the teats before milking instead of washing them.
- 2) Testing for subclinical mastitis
  - (a) Producers should give tests at least once every month to detect the high somatic cell counts caused by subclinical mastitis.
  - (b) Producers can administer the California Mastitis Test.
  - (c) Laboratory tests can be used to determine somatic cell counts more accurately.
- 3) Prevention of infections during the dry period - Producers treat the cow's mammary glands with long-lasting antibiotics that will combat infections that may be present and prevent mastitis.

b) Treatment

- 1) One treatment is frequent milking of the cow; the toxins causing the infection can be milked out with repeated milkings.
- 2) Some producers give cows an injection of oxytocin, which is a naturally occurring hormone causing milk secretion; the additional oxytocin allows the cow to be more completely milked out with a normal milking routine.
- 3) They may also give cows antibiotics to treat mastitis; however, they must discard the milk from cows treated with most antibiotics.

3. Ask students what the common health problems in raising replacement heifers are. Write the suggestions on the board or overhead.

**What are common herd health problems in raising replacement heifers?**

- a) Diarrhea, or scours, is the biggest health concern; it can cause severe dehydration if not treated properly.
- b) Brucellosis
  - 1) Brucellosis causes abortions, sterility, and reduced milk production.
  - 2) Heifers should be vaccinated at four to seven months of age.
- c) Leptospirosis
  - 1) Leptospirosis causes abortions.
  - 2) Heifers should be vaccinated against leptospirosis and other reproductive diseases before breeding.

- d) Bovine rhinotracheitis (IBR), pasteurella (PI3), bovine virus diarrhea (BVD), and blackleg - Heifers should be vaccinated between weaning and eight months of age, with boosters given as appropriate.
4. Ask students to describe how medications should be administered to dairy cattle.

**How are medications administered?**

- a) Intramuscular (IM) - made into the muscle; should be given in the neck
- b) Subcutaneous (Sub-Q) - given between the skin and muscle; should be given in the loose skin on the side of the neck
- c) Oral - given by mouth
- d) Intranasal (IN) - given as a nasal spray
- e) Intravenous (IV) - given directly into the jugular vein

**F. Other Activities**

- 1. Conduct a research project with a local dairy producer on the incidence of mastitis in his or her herd and the control measures used to prevent it.
- 2. Profile various medications used in beef and dairy cattle. Note the restrictions for lactating and nonlactating cows.

**G. Conclusion**

Dairy producers must be able to detect and treat herd health problems. Mastitis is the most serious dairy herd health problem. Other diseases that affect lactating cows are milk fever and ketosis. Replacement heifers also have specific health concerns. Medicines must be used correctly when treating these diseases.

**H. Answers to Evaluation**

- 1. b
- 2. b
- 3. a
- 4. c
- 5. d
- 6. b
- 7. Subcutaneous injections should be given between the skin and muscle in the loose skin on the side of the neck.
- 8. The symptoms of subclinical mastitis are decreased milk production and an elevated somatic cell count.

UNIT - INTRODUCTION TO DAIRY PRODUCTION

Name \_\_\_\_\_

Lesson 5: Herd Health

Date \_\_\_\_\_

EVALUATION

Circle the letter that corresponds to the best answer.

1. Which dairy herd health problem causes the greatest economic losses?
  - a. Scours
  - b. Mastitis
  - c. Ketosis
  - d. Milk fever
2. What is one factor in preventing mastitis?
  - a. Antibiotic usage
  - b. Proper sanitation
  - c. Proper equipment design
  - d. Good selection
3. What is the biggest health concern when raising replacements?
  - a. Scours
  - b. Brucellosis
  - c. Leptospirosis
  - d. Ketosis
4. When should replacement heifers be vaccinated for brucellosis?
  - a. One to two months of age
  - b. Three to eight months of age
  - c. Four to seven months of age
  - d. One year of age
5. Of what disease is a fruity odor to milk a symptom?
  - a. Mastitis
  - b. Leptospirosis
  - c. Milk fever
  - d. Ketosis
6. How often should producers test the herd for subclinical mastitis?
  - a. At least once a week
  - b. At least once a month
  - c. At least once every six months
  - d. At least once a year

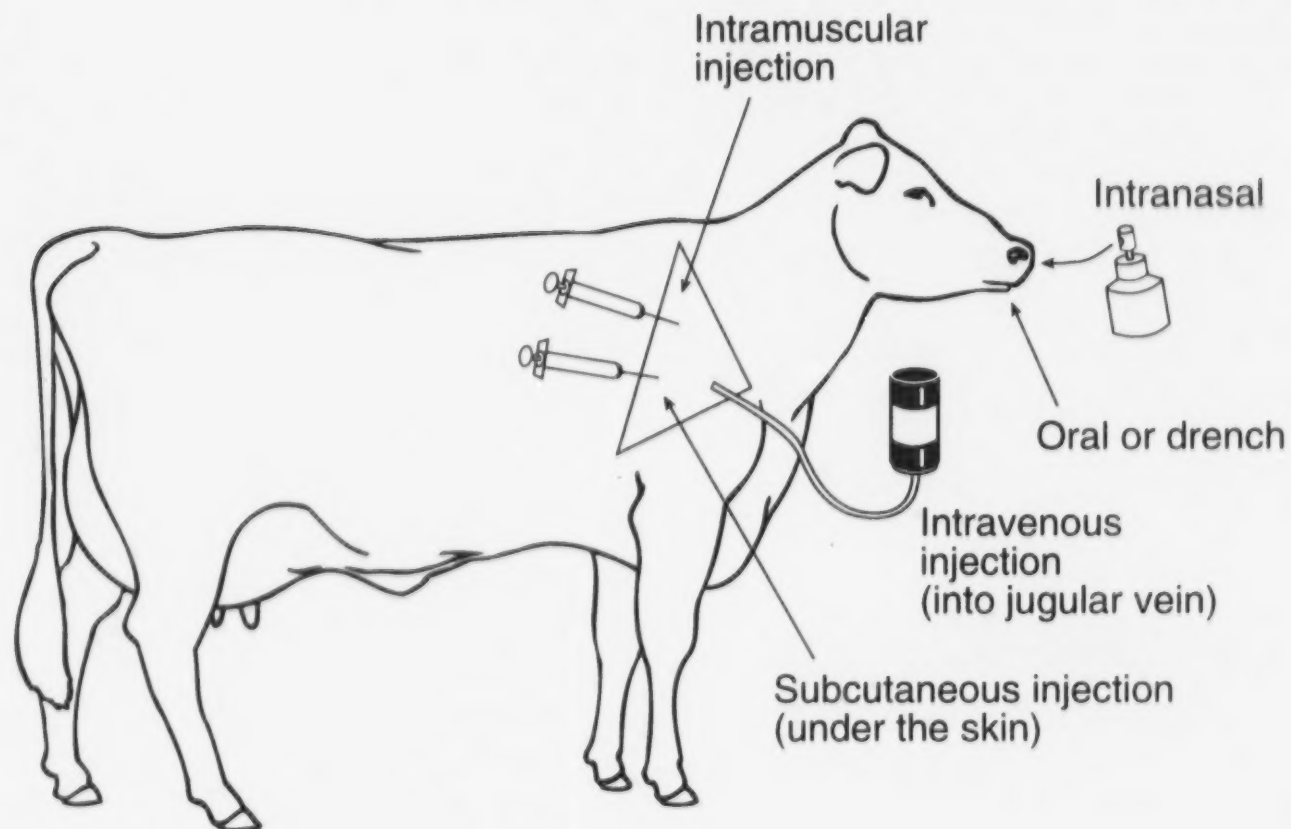
**Complete the following short answer questions.**

7. Where should a subcutaneous injection be given?
8. What are the symptoms of subclinical mastitis?

## Health Problems in Lactating Dairy Animals

| Health Problems | Symptoms | Treatment/Prevention |
|-----------------|----------|----------------------|
| Milk fever      |          |                      |
| Ketosis         |          |                      |
| Mastitis        |          |                      |

## Routes of Administration



67

63

64

TM 5.2

**California Mastitis Test (CMT)**

**Objective:** Use the California Mastitis Test.

**Materials and Equipment:**

Test paddle  
Reagent  
Store-bought milk sample  
Milk sample from a local dairy cow with mastitis

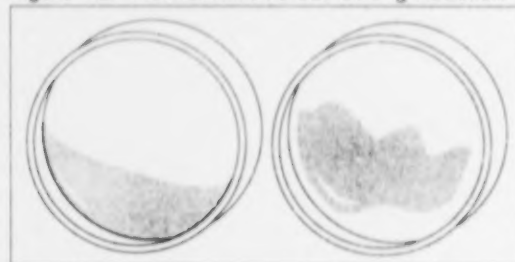
**Procedure:**

1. Place approximately half a teaspoon of each of the milk samples into the test paddle.
2. Add half a teaspoon of test reagent to each sample (Figure 1.1).
3. Gently rotate the paddle to mix the milk and reagent.
4. Ten to fifteen seconds after mixing, look for changes in color and consistency. Samples from infected cows will be a deep purple in color. Uninfected milk will remain liquid, while infected milk that reacts strongly will clump together in a gel (Figure 1.2). The milk forms small masses of gel in a moderate reaction.

Figure 1.1 - Test Paddle and Reagent



Figure 1.2 - Normal Milk Versus Strong Reaction



## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 6: Industry Issues

Competency/Objective: Evaluate issues concerning the dairy industry.

#### Study Questions

1. What are some concerns consumers have about the dairy industry?
2. How is the dairy industry addressing consumer concerns?
3. How does the consumer know that he or she has a safe food product?

#### References

1. *Introduction to Dairy Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
2. Activity Sheet
  - a) AS 6.1: Debate--Animal Welfare

## UNIT - INTRODUCTION TO DAIRY PRODUCTION

### Lesson 6: Industry Issues

#### TEACHING PROCEDURES

##### A. Review

Lesson 5 discussed herd health problems in lactating cows and replacement heifers. Dairy producers need to be especially aware of mastitis in the herd, since this disease is the chief cause of losses in the industry. Lesson 5 also described the correct way to administer health products. Lesson 6 will address industry issues concerning dairy production. Consumer concerns can have an impact on milk consumption. The dairy industry is attempting to address these concerns by educating producers and the public about these issues.

##### B. Motivation

Bring in an empty milk container. Ask the students whether they think the milk is safe. Discuss the possibility of medications ending up in the fluid milk supply.

##### C. Assignment

##### D. Supervised Study

##### E. Discussion

1. Ask students what concerns consumers have about dairy production. Discuss why consumers might be concerned about these things.

#### **What are some concerns consumers have about the dairy industry?**

- a) Waste management - contamination of ground and surface water by improperly handled, untreated wastes
  - b) Drug usage in lactating cows - presence of drugs given to lactating cows in fluid milk, which may be harmful to humans
  - c) Animal welfare - how management practices affect animal comfort and well-being; for example, that cows and calves do not have sufficient freedom to move around and that they may not always be adequately supplied with shade and shelter
2. Ask the class what dairy producers are doing to address consumer concerns. Have students carry out the debate outlined in AS 6.1. Divide the class into two groups and allow the groups to research the subject to prepare for the debate. Moderate the debate for the class.

#### **How is the dairy industry addressing consumer concerns?**

- a) Waste management - education by the industry concerning waste storage, management, and land application
- b) Drug usage - Milk and Dairy Beef Quality Assurance programs
  - 1) Programs educating producers about management practices that can help them produce high quality milk and pure beef products
  - 2) Focus on several points that can help producers improve their milk, including proper herd health management, sanitation, feeding, and record keeping
- c) Animal welfare - information by dairy-related agencies to educate producers about management practices that will ensure animal welfare

3. Ask the class how they know that the food supply, especially dairy products, is safe.

**How does the consumer know that he or she has a safe food product?**

Consumers can be sure that dairy products are safe because of inspections by the USDA and state regulatory agencies.

- a) State inspections are carried out to look at factors such as drug usage and sanitation in the milking parlor.
- b) Milk samples are tested for contaminants at both the farm and the processing plant to confirm that the milk is safe.
- c) Milk unfit for human use is added to animal feeds or dumped.

F. Other Activities

G. Conclusion

Dairy producers must be aware of the public's perception of current dairy practices. Producers should educate themselves and consumers about the safety of dairy products and the management practices used in American dairy production.

H. Answers to Evaluation

- 1. d
- 2. c
- 3. Milk that is unfit for human consumption is used in animal feeds or dumped.
- 4. They are designed to educate producers about management practices that can help them produce high quality milk and pure beef products.
- 5. Consumers worry that cows and calves do not have sufficient freedom to move around and that they may not always be adequately supplied with shade and shelter.

UNIT - INTRODUCTION TO DAIRY PRODUCTION

Name \_\_\_\_\_

Lesson 6: Industry Issues

Date \_\_\_\_\_

EVALUATION

**Circle the letter that corresponds to the best answer.**

1. What federal agency is responsible for inspecting milk in the United States?
  - a. Federal Trade Commission
  - b. Missouri Department of Agriculture
  - c. Food and Drug Administration
  - d. United States Department of Agriculture
2. What is the chief concern connected to management of wastes from dairy operations?
  - a. Odor from dairy operations
  - b. Contamination of milk with drug residues
  - c. Contamination of ground and surface water
  - d. The effect on animals of large-scale confinement operations

**Complete the following short answer questions.**

3. What happens to milk that is unfit for human consumption?
4. What are the Milk and Dairy Beef Quality Assurance programs designed to do?
5. What are two things that consumers worry about concerning the welfare of dairy animals?

**Debate--Animal Welfare**

**Objective:** Explore issues surrounding dairy production.

Your class will be conducting a debate about the welfare of dairy cattle. Your instructor will assign you to a group to argue for or against the management practices used in dairy production. Use any available resources to find information that supports your argument. Your research should answer the following questions. You should bring up any other relevant points you discover in your research during the debate.

- Should calves be separated from cows soon after calving?
- Should calves be raised individually rather than in groups?
- Are calves given enough space to move around when they are placed in individual pens?
- Do cows have enough freedom to move around in barns?

When you have completed researching your position, your instructor will moderate the debate.

## DAIRY CATTLE

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Registrations 10,518  
1 - WI; 2 - PA; 3 - MN; 4 - IA; 5 - OH  
Breed Publication: Guernsey Breeders' Journal

**The American Jersey Cattle Association**

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Registrations 56,165  
1 - CA; 2 - OH; 3 - WI; 4 - PA; 5 - TX  
Breed Publication: Jersey Journal

**American Milking Shorthorn Society**

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**Stuart Rowe, Executive Secretary**  
Phone: (608) 365-3332 Fax: (608) 365-6644  
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Breed Publication: Milking Shorthorn Journal

**Ayrshire Breeders' Association**

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Phone: (802) 254-7460 Fax: (802) 257-4332  
Registrations 6,684  
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Breed Publication: Ayrshire Digest

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P.O. Box 1038, Beloit, WI 53512-1038  
**John Meyer, Executive Secretary**  
Phone: (608) 365-4474 Fax: (608) 365-5577  
Registrations 10,331  
1 - WI; 2 - IA; 3 - OH; 4 - MN; 5 - PA  
Breed Publication: Brown Swiss Bulletin

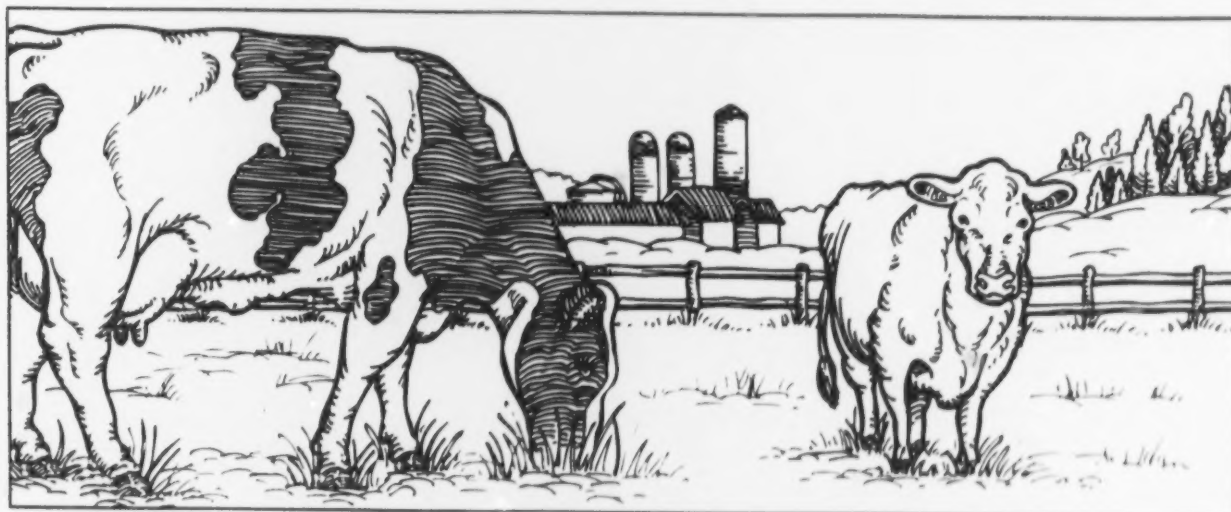
**Holstein Association USA, Inc.**

1 Holstein Place, P.O. Box 808, Brattleboro, VT 05302-0808  
**Stephen R. Kerr, Chief Executive Officer**  
Phone: (800) 952-5200; Fax: (802) 254-8251  
Registrations 327,701  
1 - WI; 2 - PA; 3 - NY; 4 - CA; 5 - OH  
Breed Publication: Holstein World, P.O. Box 299, Sandy Creek, NY 13145

Introduction to

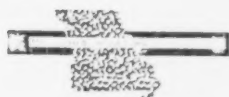
# DAIRY PRODUCTION

student  
reference



In cooperation with  
Agricultural Education  
Department of Practical  
Arts and Vocational  
Technical Education  
College of Education and  
College of Agriculture  
Food and Natural  
Resources  
University of Missouri-  
Columbia

In cooperation with  
Agricultural Education  
Section  
Division of Vocational and  
Adult Education  
Elementary and Secondary  
Education  
Jefferson City, Missouri



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University of Missouri-Columbia  
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Columbia, MO 65211  
573-882-2883

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## INTRODUCTION TO DAIRY PRODUCTION

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## FOREWORD

The development of the *Introduction to Dairy Production* curriculum guide is the result of suggestions by the MVATA Teaching Aids Committee. The Dairy Production Advisory Committee suggested the topics to be included and reviewed the materials.

This student reference contains six lessons. Topics include an introduction to the dairy industry, breeds of dairy cattle, principles of dairy cattle selection, herd management, herd health, and industry issues. An instructor's guide can be purchased separately.

During the summer of 1981, the Missouri State Board of Education formally adopted the concept of "Instructional Management Systems" (IMS) as a priority for the 1981-82 school year. The Missouri Commissioner of Education described the IMS concept as a practical way of "organizing for excellence" in education. To meet the demand for greater productivity and accountability, the director of Vocational Education applied the elements of IMS to form the Vocational Instructional Management System (VIMS). The VIMS process provides a framework to use in planning and organizing to assure excellence in Missouri's vocational education system by focusing greater attention on the management of teaching and learning.

The instructor's guide to accompany this student reference incorporates the needed component parts to aid agriculture teachers in the implementation of VIMS.

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University of Missouri-Columbia

Terry Heiman, Director  
Agricultural Education  
Department of Elementary and  
Secondary Education

# INTRODUCTION TO DAIRY PRODUCTION

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## Introduction to the Dairy Industry

The dairy industry is an important component of Missouri's animal agriculture industry. Dairy cow operations are found throughout the state. Many Missouri producers derive their entire income from the dairy industry.

### The Dairy Industry in Missouri

Dairy production is important to Missouri agriculture. In 1995, Missouri ranked eighth among the states in the number of milk cow operations; it ranked thirteenth in milk production. More than 190,000 head of dairy cows were present throughout the state. Each of these cows produced an average of 14,158 pounds of milk during the year. The production of milk generated almost \$350 million of income. Dairy producers are primarily located in southwest Missouri around Springfield. As of January 1, 1996, Wright County was the top dairy county in Missouri with 16,650 head of dairy cows. Figure 1.1 illustrates dairy cow numbers in Missouri.

### Evolution of the Dairy Industry

The dairy industry began when settlers brought cows to colonial America in the early 1600s. Until

the mid-nineteenth century, a cow's owner consumed most of the milk it produced. Some milk and other dairy products were sold to people who lived nearby and did not have their own cows.

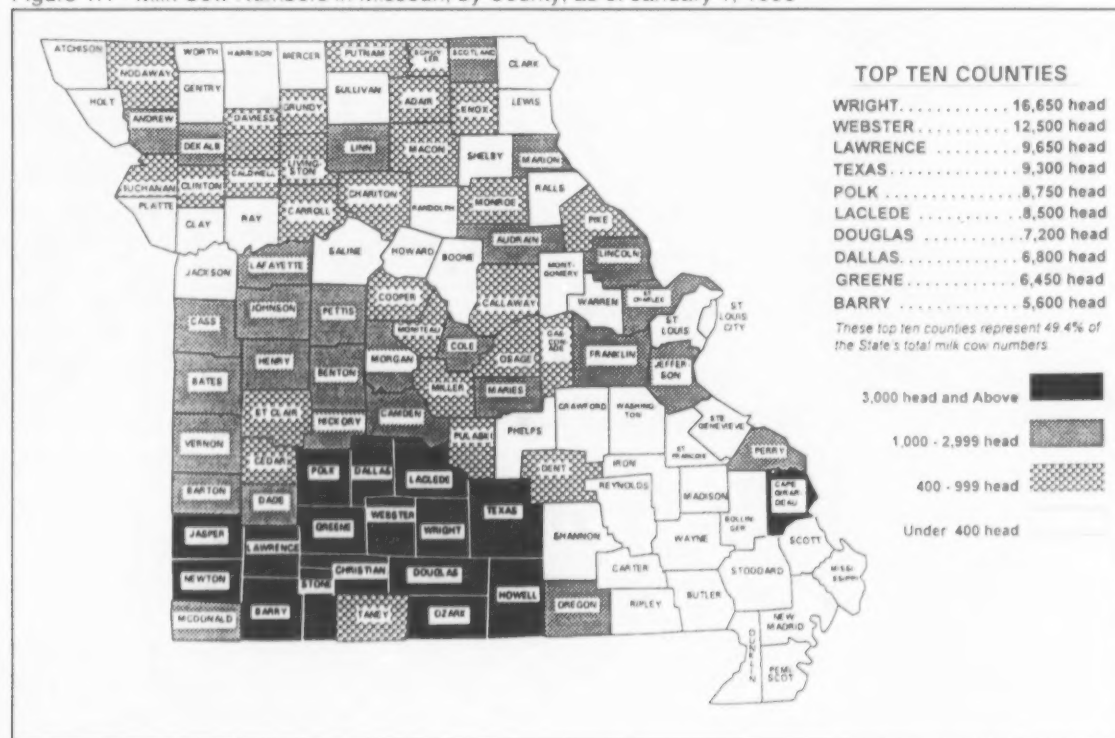
In the nineteenth century, technological advancements led to the growth of the dairy industry. Refrigerated railroad cars allowed producers to ship their milk long distances to urban areas. Milk began to be pasteurized, which involves treating milk by heating it to kill disease-causing bacteria. Commercially manufactured cheese became available as well.

These advances allowed dairy production to become a commercial business. Today, dairy operations supply milk to many people. Through improved breeding, selection, and nutrition, a modern dairy cow can produce thousands of additional pounds of milk.

### Modern Trends

Dairy operations have changed over the last several decades. The number of dairy operations nationwide has decreased, but the number of cows

Figure 1.1 - Milk Cow Numbers in Missouri, by County, as of January 1, 1996



## Introduction to Dairy Production

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per farm has increased. Dairy production is usually the sole enterprise of these operations.

Milk production per cow has increased due to management factors, including the introduction of BST (bovine somatotropin). BST is a naturally occurring hormone that can be synthesized through biotechnology. It improves milk production when given to lactating cows. Producers are thus able to increase the milk production of existing dairy cows. Using BST requires precise nutritional management of the dairy herd. In the past, some consumers were concerned about the safety of using BST; they feared the residues would show up in fluid milk. Today, however, most consumers have accepted the use of BST.

The location of dairy production has also shifted from the Midwest to the western United States. Large dairies are now found in California, Arizona, and New Mexico. The warm, dry climate allows animals to be managed in dry lots with minimal housing. High quality alfalfa hay grown using irrigation is also abundant, creating a good supply of feed. Dairies in these states are often large, with more than 1,000 head of dairy cows.

### Career Opportunities

The dairy industry offers many challenging and rewarding careers. Areas such as production, genetics, nutrition, and veterinary services, as well as dairy product transportation, processing, and promotion, are open to individuals who are interested in the industry. Some possible careers are described below.

Dairy producers are directly involved in the production of milk for fluid milk and milk products, such as cheese and ice cream. They also may supply dairy animals to other producers. Dairy producers often own part or all of their operations.

Other careers are also available in the industry. Loan officers are needed to work in agricultural financing in banks or other lending institutions providing financial management planning or loans for dairy enterprises. Geneticists are available to help with breeding decisions and reproductive work such as embryo transfer. Feed company representatives provide information about feeds and

nutrition to dairy producers. Veterinarians help care for dairy animals and provide advice and supplies to maintain animal health and the production levels of the dairy operation. Equipment sales and service representatives sell and service equipment used for milk production. Fluid milk haulers transport fluid milk to the processing plant or milk cooperative. Processing plant supervisors help ensure the safety of dairy food products. Sales representatives for dairy food products market dairy products to wholesale and retail stores where they are sold to the public.

### Conclusion

The dairy industry is important to agriculture in Missouri and the United States. The dairy industry has undergone many changes from its beginnings, when the milk produced by cows was consumed chiefly by their owners. Today's dairy producers are producing more milk with fewer cows. In addition to milk production, thousands of other careers are tied to the modern dairy industry.

### Credits

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Taylor, Robert E., and Ralph Bogart. *Scientific Farm Animal Production*. 3rd ed. New York: Macmillan Publishing, 1988.

## Breeds of Dairy Cattle

Compared to beef cattle, few breeds of dairy cattle exist. Most dairy cows are purebred. The primary objective of selecting a breed is to find cattle that will produce large amounts of milk over a long period.

### Breeds

Six major dairy breeds are used in Missouri. They are Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and the Milking Shorthorn.

Ayrshire - This breed is red and white in color. Ayrshire cows are generally excellent grazers with high quality udders. Ayrshires are not used extensively in the dairy industry because of their low milk production in comparison to Holsteins and Brown Swiss cattle. The breed originated in Scotland and was imported into America in the early nineteenth century.

Brown Swiss - Brown Swiss cattle are light to dark brown with black noses and tongues. The cows are large in size. They rank second to Holsteins in average pounds of milk produced per animal. Brown Swiss cattle are recognized as a heat-tolerant breed and are often used in tropical areas of the world. They can be used as a dual purpose breed for milk and beef production. This breed was first brought to the United States from Switzerland in 1869.

Guernsey - Guernsey cattle are pale yellow and white in color. Milk from Guernseys has a golden color due to high levels of beta-carotene, a source of vitamin A. Guernseys are second to Jerseys in the percentage of fat and protein in their milk. This breed was first imported into the United States from the Isle of Guernsey in the English Channel in the early 1800s.

Holstein - Holsteins are the most popular of all dairy breeds. Worldwide, Holsteins are the most numerous breed of cattle. They are black and white, or occasionally red and white. Holsteins are the largest of the dairy breeds in size. Cows of this breed rank first in average pounds of milk produced per animal. Holstein cattle were first imported into the United States from the Netherlands in the early seventeenth century.

Jersey - Jersey cattle vary in color from fawn to light brown, gray, or almost black. Jerseys tend to be the smallest of the dairy breeds in size. Cows produce milk that has the highest percentage of milk fat and milk protein of the breeds. This breed is recognized

as more tolerant of heat stress than Holsteins. Jerseys were imported into the United States in the early nineteenth century from the Isle of Jersey in the English Channel.

Milking Shorthorn - Milking Shorthorns are red, white, or any combination of the two colors. They are known as a dual purpose breed because the cattle can be used for both beef and milk production. Milking Shorthorns were recognized as a breed in the 1940s. The breed originated in England.

### Breed Selection

Selecting breeds to be used in a dairy operation depends on the goals of the producer. The primary goal of most producers is to maximize milk production, which is why Holsteins are by far the most popular dairy breed. However, other breeds have desirable qualities that the producer may wish to add to his or her herd. For example, many producers have herds primarily consisting of Holsteins, but they include some cows from other breeds that produce more milk fat and milk protein to boost the levels of these components in their milk. The selection of individual animals is important as well because animals from all breeds can be high producers.

### Conclusion

The major dairy breeds are the Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and Milking Shorthorn. Most producers seek to maximize milk production when selecting one of these breeds for their dairy operations.

### Credits

Baker, Meelee, and Robert E. Mikesell. *Animal Science Biology and Technology*. Danville, Ill.: Interstate Publishers, Inc., 1996.

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Taylor, Robert E., and Ralph Bogart. *Scientific Farm Animal Production*. 3rd ed. New York: Macmillan Publishing, 1988.

## Principles of Dairy Cattle Selection

Dairy producers face a major task when selecting replacement heifers and choosing which cows in the current herd to keep or to sell. Maximizing milk production is the primary goal of dairy producers. When a producer selects females for his or her herd, the decision may affect the operation's long-term success in the dairy industry because of the longevity and genetic influence of the dairy cow and her offspring.

### Parts of a Dairy Cow

When describing dairy cattle, proper terminology is essential to be able to communicate properly with other individuals involved in the dairy industry. Figure 3.1 is an illustration of the parts of a dairy cow.

### Dairy Cow Unified Score Card

The dairy breed associations and dairy producers developed the Dairy Cow Unified Score Card (Figure 3.2) in the 1940s. The dairy score card has been revised often, most recently in 1994. Producers should use the score card to help evaluate and select cows for production. It

compares cows to an ideal cow, which is given a score of 100 points; they are then classified according to their scores. The classifications are as follows:

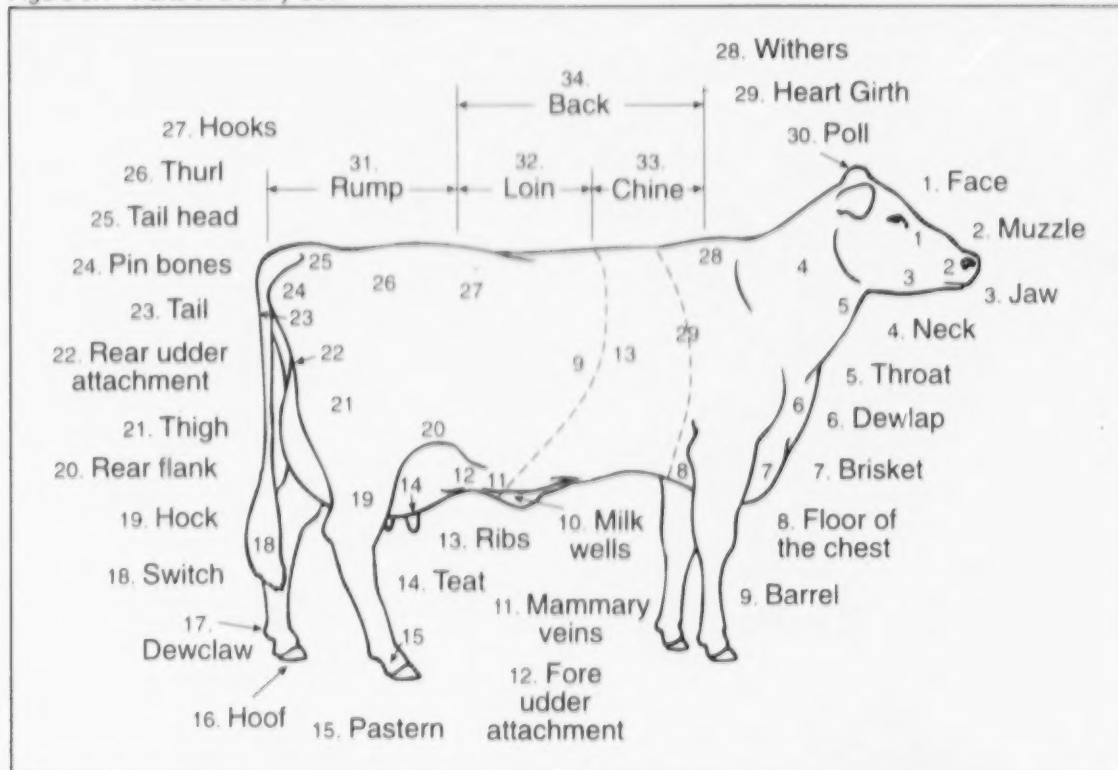
|           |                     |
|-----------|---------------------|
| Excellent | 90-100 points       |
| Very Good | 85-89 points        |
| Good Plus | 80-84 points        |
| Good      | 75-79 points        |
| Fair      | 70-74 points        |
| Poor      | Less than 70 points |

The Dairy Cow Unified Score Card looks at five major traits for classification. These traits are frame, dairy character, body capacity, feet and legs, and udder.

**Frame** (15 points) - The skeletal parts of the cow, except the feet and legs, are evaluated in this category. Dairy cattle should be tall and long-bodied with a straight, strong back; a long, level rump; and a long, clean neck.

**Dairy character** (20 points) - Dairy character provides a prediction of future milk production through the evaluation of milking ability. Dairy cattle

Figure 3.1 - Parts of a Dairy Cow

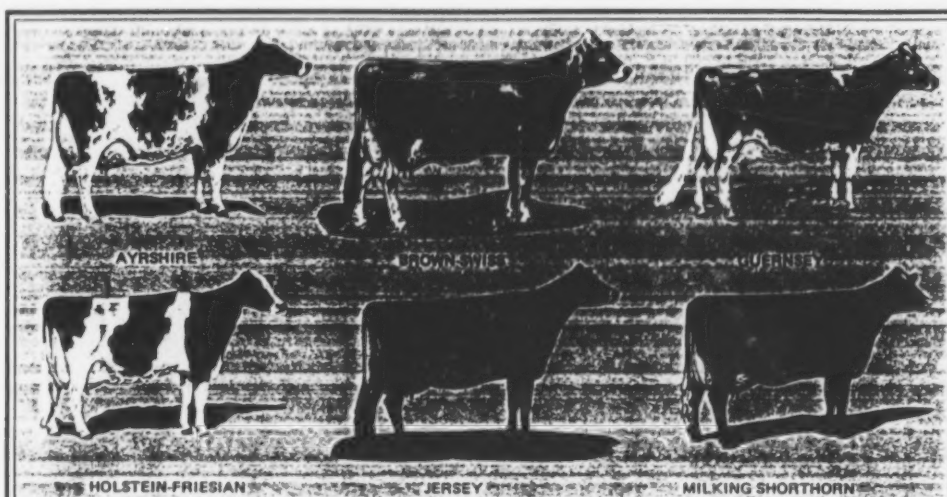


## Introduction to Dairy Production

Figure 3.2 - Dairy Cow Unified Score Card

| DAIRY COW UNIFIED SCORE CARD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                         |
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| Copyrighted by The Purebred Dairy Cattle Association, 1943. Revised and Copyrighted 1957, 1971, 1982, and 1994.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                         |
| Breed characteristics should be considered in the application of this score card                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                         |
| <p><b>MAJOR TRAIT DESCRIPTIONS</b></p> <p>There are five major classification traits on which a classifier bases a cow's score. Each trait is broken down into body parts to be looked at and ranked.</p> <p><b>1) Frame - 15%</b></p> <p>The skeletal parts of the cow, with the exception of feet and legs, are evaluated. Listed in priority order, the descriptions of the traits to be considered are as follows:</p> <p><b>Rump</b> - long and wide throughout with pin bones slightly lower than hip bones. Thurls need to be wide apart and centrally placed between hip bones and pin bones. The tailhead is set slightly above and neatly between pin bones, and the tail is free from coarseness. The vulva is nearly vertical. <b>Stature</b> - height, including length in the leg bones. A long bone pattern throughout the body structure is desirable. Height at the withers and hips should be relatively proportionate. <b>Front End</b> - adequate constitution with front legs straight, wide apart and squarely placed. Shoulder blades and elbows need to be firmly set against the chest wall. The crops should have adequate fullness. <b>Back</b> - straight and strong, the loin - broad, strong, and nearly level. <b>Breed Characteristics</b> - overall style and balance. Head should be feminine, clean-cut, slightly dished with broad muzzle, large open nostrils and a strong jaw is desirable.</p> <p>Rump, Stature, and Front End receive primary consideration when evaluating Frame.</p> <p><b>2) Dairy Character - 20%</b></p> <p>The physical evidence of milking ability is evaluated. Major consideration is given to general openness and angularity while maintaining strength, flatness of bone and freedom from coarseness. Consideration is given to stage of lactation. Listed in priority order, the descriptions of the traits to be considered are as follows:</p> <p><b>Ribs</b> - wide apart. Rib bones are wide, flat, deep, and slanted toward the rear. <b>Thighs</b> - lean, inclining to flat, and wide apart from the rear. <b>Withers</b> - sharp with the chine prominent. <b>Neck</b> - long, lean, and blending smoothly into shoulders. A clean-cut throat, dewlap, and brisket are desirable. <b>Skin</b> - thin, loose, and pliable.</p> <p><b>3) Body Capacity - 10%</b></p> <p>The volumetric measurement of the capacity of the cow (length x depth x width) is evaluated with age taken into consideration. Listed in priority order the descriptions of the traits to be considered are as follows:</p> <p><b>Barrel</b> - long, deep, and wide. Depth and spring of rib increase toward the rear with a deep flank. <b>Chest</b> - deep and wide floor with well-sprung fore ribs blending into the shoulders.</p> <p>The Barrel receives primary consideration when evaluating Body Capacity.</p> <p><b>4) Feet and Legs - 15%</b></p> <p>Feet and rear legs are evaluated. Evidence of mobility is given major consideration. Listed in priority order, the descriptions of the traits to be considered are as follows:</p> <p><b>Feet</b> - steep angle and deep heel with short, well-rounded closed toes. <b>Rear Legs</b> - <b>Rear View</b> - straight, wide apart with feet squarely placed. <b>Side View</b> - a moderate set (angle) to the hock. <b>Hocks</b> - cleanly molded, free from coarseness and puffiness with adequate flexibility. <b>Pasterns</b> - short and strong with some flexibility.</p> <p>Slightly more emphasis placed on Feet than on Rear Legs when evaluating this breakdown.</p> <p><b>5) Udder - 40%</b></p> <p>The udder traits are the most heavily weighted. Major consideration is given to the traits that contribute to high milk yield and a long productive life. Listed in priority order, the descriptions of the traits to be considered are as follows:</p> <p><b>Udder Depth</b> - moderate depth relative to the hock with adequate capacity and clearance. Consideration is given to lactation number and age.</p> <p><b>Teat Placement</b> - squarely placed under each quarter, plumb and properly spaced from side and rear views.</p> <p><b>Rear Udder</b> - wide and high, firmly attached with uniform width, from top to bottom and slightly rounded to udder floor.</p> <p><b>Udder Cleft</b> - evidence of a strong suspensory ligament indicated by adequately defined halving.</p> <p><b>Fore Udder</b> - firmly attached with moderate length and ample capacity.</p> <p><b>Teats</b> - cylindrical shape and uniform size with medium length and diameter.</p> <p><b>Udder Balance and Texture</b> - should exhibit an udder floor that is level as viewed from the side. Quarters should be evenly balanced, soft, pliable and well collapsed after milking.</p> | <p>Perfect Score</p> <p>15</p> <p>20</p> <p>10</p> <p>15</p> <p>40</p> <p>TOTAL 100</p> |
| <p><b>PARTS OF A DAIRY COW</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                         |

Courtesy of the Purebred Dairy Cattle Association.



## BREED CHARACTERISTICS

Except for differences in color, size and head character, all breeds are judged on the same standards as outlined in the Unified Score Card. If any animal is registered by one of the dairy breed associations, no discrimination against color or color pattern is to be made.

### AYRSHIRE

Strong and robust, showing constitution and vigor, symmetry, style and balance throughout, and characterized by strongly attached, evenly balanced, well-shaped udder.

**HEAD:** clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dishd; bridge of nose straight; ears medium size and alertly carried.

**COLOR:** light to deep cherry red, mahogany, brown, or a combination of any of these colors with white, or white alone, distinctive red and white markings preferred.

**SIZE:** a mature cow in milk should weigh at least 1200 lbs.

### HOLSTEIN

Rugged, feminine qualities in an alert cow possessing Holstein size and vigor.

**HEAD:** clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dishd; bridge of nose straight; ears medium size and alertly carried.

**COLOR:** black and white or red and white markings clearly defined.

**SIZE:** a mature cow in milk should weigh a minimum of 1500 lbs.

### MILKING SHORTHORN

Strong and vigorous, but not coarse.

**HEAD:** clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dishd; bridge of nose straight; ears, medium size and alertly carried.

**COLOR:** red or white or any combination. (No black markings allowed).

**SIZE:** a mature cow should weigh 1400 lbs.

### BROWN SWISS

Strong and vigorous, but not coarse. Size and ruggedness with quality desired. Extreme refinement undesirable.

**HEAD:** clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and slightly dishd; bridge of nose straight; ears medium size and alertly carried.

**COLOR:** solid brown varying from very light to dark. Muzzle is black encircled by a mealy colored ring, and the tongue, switch and hooves are black.

**SIZE:** a mature cow in milk should weigh 1500 lbs.

### GUERNSEY

Size and strength, with quality and character desired.

**HEAD:** clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and slightly dishd; bridge of nose straight; ears medium size and alertly carried.

**COLOR:** a shade of fawn with white markings throughout clearly defined. When other points are equal, clear (buff) muzzle will be favored over a smoky or black muzzle.

**SIZE:** a mature cow in milk should weigh at least 1150 lbs.

### JERSEY

Sharpness with strength indicating productive efficiency.

**HEAD:** proportionate to stature showing refinement and well chiseled bone structure. Face slightly dishd with dark eyes that are well set.

**COLOR:** some shade of fawn with or without white markings. Muzzle is black encircled by a light colored ring, and the tongue and switch may be either white or black.

**SIZE:** a mature cow in milk should weigh about 900 lbs.

## FACTORS TO BE EVALUATED

The degree of discrimination assigned to each defect is related to its function and heredity. The evaluation of the defect shall be determined by the breeder, the classifier or the judge, based on the guide for discrimination and disqualifications given below.

### HORNS

No discrimination for horns.

### EYES

1. Blindness in one eye. Slight discrimination.
2. Cross or bulging eyes. Slight discrimination.
3. Evidence of blindness. Slight to serious discrimination.
4. Total blindness. Disqualification.

### WRY FACE

Slight to serious discrimination.

### CROPPED EARS

Slight discrimination.

### PARROT JAW

Slight to serious discrimination.

### SHOULDERS

Winged. Slight to serious discrimination.

### TAIL SETTING

Any tail or other abnormal tail settings.

Slight to serious discrimination.

### CAPPED HIP

No discrimination unless effects mobility.

### LEGS AND FEET

1. Lameness - apparently permanent and interfering with normal function. Disqualification.
2. Lameness - apparently temporary and not affecting normal function. Slight discrimination.
3. Evidence of crampy hind legs. Serious discrimination.
4. Evidence of fluid in hocks. Slight discrimination.
5. Weak pastern. Slight to serious discrimination.
6. Toe out. Slight discrimination.

### UDDER

1. Lack of defined udder. Slight to serious discrimination.
2. Udder definitely broken away in attachment. Serious discrimination.
3. A weak udder attachment. Slight to serious discrimination.
4. Blind quarter. Disqualification.
5. One or more light quarters, hard spots in udder, obstruction in teat (spider). Slight to serious discrimination.

### 6. Side leak. Slight discrimination.

7. Abnormal milk (bloody, clotted, watery).

Possible discrimination.

### LACK OF SIZE

Slight to serious discrimination.

### EVIDENCE OF SHARP PRACTICE

(Refer to FDCA Code of Ethics)

1. Animals showing signs of having been tampered with to conceal faults in conformation and to misrepresent the animal's soundness.
2. Uncastrated heifers showing evidence of having been mixed. Slight to serious discrimination.

### TEMPORARY OR MINOR INJURIES

Blemishes or injuries of a temporary character not affecting animal's usefulness. Slight to serious discrimination.

### OVERCONDITIONED

Slight to serious discrimination.

### FREEMARTIN HEIFERS

Disqualification.

## Introduction to Dairy Production

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should have wide, flat ribs and be lean in appearance, with sharp withers.

Body capacity (10 points) - Body capacity is an evaluation of the volume of the cow. It determines the amount of feed the animal is able to consume, which affects milk production. Dairy cows should be long, deep, and wide through the barrel and chest floor.

Feet and legs (15 points) - Looking at the feet and legs allows an individual to evaluate skeletal soundness, or the ability of the cow to move easily.

Udder (40 points) - The udder is the most important part of the dairy cow. Udders are evaluated for milk production and productivity over time. The cow's udder size, cleft, balance, and teat placement should be considered.

### Linear Evaluation

Linear evaluation is another type of evaluation system in which a computer program is used to score cattle for individual traits. Dairy producers use this information to improve the functional type of the dairy herd by selecting animals for breeding.

Linear classification scores cows on seventeen linear traits by assigning a numerical score between one and fifty. A linear trait is a simple trait that can be scored along a range from one extreme to another. Depending on the specific trait, a high, low, or moderate point value is desirable. The linear traits are:

- stature
- strength
- body depth
- dairy form
- rump angle
- rump width
- rear legs (side view)
- foot angle
- fore udder attachment
- rear udder height
- rear udder width
- udder cleft
- udder depth

- front teat placement
- teat length
- rear legs (rear view)
- udder tilt

Linear evaluation and classification allows producers to pinpoint specific traits in cows that should be improved and then select bulls for breeding. They can also evaluate and select bulls for breeding by using their daughters' scores. Future generations of replacements will be sounder and more productive.

### Summary

To help in evaluating animals, producers must know the correct names of the parts of a dairy cow. The Dairy Cow Unified Score Card is one method of evaluating dairy cows for selection. Linear evaluation is a more trait-specific approach for selecting dairy animals for breeding.

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Dairy herd management is an important part of dairy production. Dairy operations require a large investment and usually operate on narrow profit margins. Producers must be aware of many factors to run a successful dairy operation. These factors are production costs, facility requirements, raising replacement heifers, reproductive management, nutritional needs, methods of feeding, record keeping, and marketing milk.

### Production Costs

Start up costs for dairy operations are quite high and require a large investment of capital. However, the types of production costs associated with dairy operations are very similar to other animal production systems. Dairy farms require more facilities than beef cattle production. Feed costs are the major cost of a dairy operation on a daily basis. Dairy operations are also extremely labor intensive, and the producer may have to hire outside help for milking. Other costs are marketing fees, fees for milk testing, veterinary fees and medicine, and building repair and maintenance.

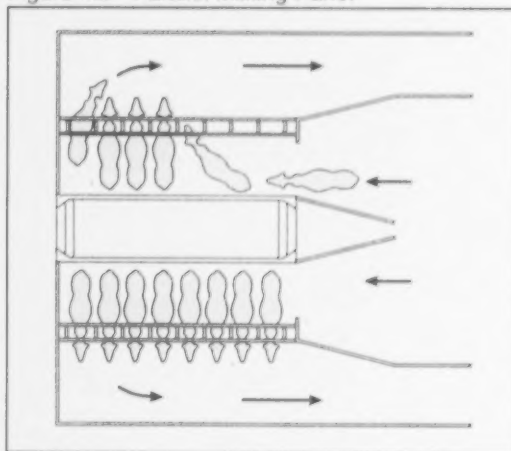
Dairy cattle can generate income from the sale of milk and cattle, including youngstock (calves and heifers), breeding bulls, and cull cows. The worksheet pictured in Figure 4.1 (see page 10) allows dairy producers to calculate income after deducting operating expenses. The producer can use this information on income and expenses to make management decisions that will allow him or her to lower costs and increase profits.

### Facilities

Dairy production has extensive facility requirements. The basic dairy facility requirements are a milking parlor, free stall or stanchion barn, feed storage, waste storage, and heifer development facilities.

Milking parlors are required for modern dairies that produce Grade A milk, or milk that is pure enough to use for fluid milk consumption. Cows are brought to the milking parlor for milking. Modern parlors are computer controlled and highly automated. In the parallel milking parlor, illustrated in Figure 4.2, the cows stand at a 90° angle on both sides of a pit where the milkers stand. The milking unit is attached between the hind legs. Another design is the herringbone design. In a herringbone milking parlor, cows stand at an angle on both sides of a pit. The design allows easy access to each cow's udder from the side for putting on and removing the

Figure 4.2 - Parallel Milking Parlor



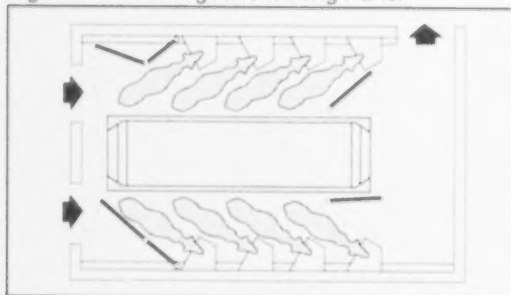
milking units. A herringbone milking parlor is shown in Figure 4.3.

Cows spend most of their time in the pasture or in free stall or stanchion barns. Free stall barns have a series of separate stalls where cows can lay down. They can move freely between the stalls. Stanchion barns are similar to free stall barns, but a headgate or a chain and collar confine the cows to their stalls. The stanchion barn allows cows to be fed separately, and the amount of feed can be regulated according to their production level.

Feed storage facilities are another requirement for dairy operations because of the large amount of feed fed to each cow. Upright silos and pit silos hold corn silage or haylage. Most dairies also have grain and bulk bins that hold prepared feeds or supplements.

Most dairies also require waste storage facilities because of the amount of production that takes place in confinement in barns, which generates a lot

Figure 4.3 - Herringbone Milking Parlor



## Introduction to Dairy Production

Figure 4.1 - Monthly Worksheet for a Dairy Operation

### Monthly Worksheet

Name of farm: \_\_\_\_\_ Name of operator: \_\_\_\_\_ Month: \_\_\_\_\_

|                                                                                                | Your farm | Example farm          |
|------------------------------------------------------------------------------------------------|-----------|-----------------------|
| <b>Gross income</b>                                                                            |           |                       |
| 1 (a) Pounds of milk sold for the month (from your milk check)                                 |           | 181,903               |
| (b) Divide (a) by 100 to get milk sales in cwt's                                               |           | 1,819                 |
| 2 Gross milk price (\$/cwt)                                                                    |           | \$12.50               |
| 3 Compute gross milk sales by multiplying 1(b) by step 2                                       |           | 22,738                |
| 4 Livestock sales related to dairy                                                             |           | 3,000                 |
| 5 Capital revolvments and other dairy income                                                   |           | 0                     |
| 6 Add lines 3, 4 and 5 for total gross receipts                                                |           | 25,738                |
| <b>Variable expenses</b>                                                                       |           |                       |
| 7 (a) Market value of purchased concentrates, alternative feeds, vitamins and minerals         |           | 6,250                 |
| (b) Market value of purchased forages consumed                                                 |           | 2,873                 |
| (c) Market value of home-raised grains consumed                                                |           | 667                   |
| (d) Market value of home-raised haylage and silage consumed                                    |           | 0                     |
| (e) Market value of home-raised hay consumed                                                   |           | 0                     |
| 8 Estimate the monthly value of pasture consumed                                               |           |                       |
| (a) Average number of head on pasture for the month                                            |           | 20                    |
| (b) Monthly pasture charge                                                                     |           | \$5                   |
| (c) Multiply (a) by (b)                                                                        |           | 100                   |
| 9 Total 7(a) through 7(e) and 8(c) to compute the total value of feedstuffs consumed           |           | 9,890                 |
| 10 Estimate the true cost of labor for the dairy enterprise                                    |           |                       |
| (a) Amount spent for hired labor for the month (including benefits)                            |           | 2,000                 |
| (b) Hours of unpaid family labor                                                               |           | 350                   |
| (c) Value of family labor                                                                      |           | \$5                   |
| (d) Multiply (b) and (c)                                                                       |           | 1,650                 |
| (e) Value of your operator labor                                                               |           | 300 hrs x \$5 = 1,600 |
| (f) Portion of time the labor force was used on the dairy enterprise                           |           | 75%                   |
| (g) Add lines (a), (d) and (e) and multiply by (f)                                             |           | 5,250 x 75% = 3,938   |
| 11 Milk check deductions                                                                       |           | 1,764                 |
| 12 Expenses for DHIA fees                                                                      |           | 200                   |
| 13 Expenses for artificial insemination                                                        |           | 283                   |
| 14 Expenses for veterinary fees and medicine                                                   |           | 500                   |
| 15 Expenses for dairy supplies, the portion of the following costs related to the dairy only   |           | 667                   |
| 16 Expenses for fuel and oil                                                                   |           | 3 x 299 = 90          |
| 17 Utility bills                                                                               |           | 5 x 558 = 279         |
| 18 Building repairs                                                                            |           | 208                   |
| 19 Machinery repairs                                                                           |           | 33 x 1050 = 347       |
| 20 Farm taxes                                                                                  |           | 0                     |
| 21 Farm insurance                                                                              |           | 5 x 300 = 150         |
| 22 Any legal and professional fees                                                             |           | 5 x 42 = 21           |
| 23 Car and truck expenses                                                                      |           | 5 x 333 = 167         |
| 24 Other expenses                                                                              |           | 100                   |
| 25 (a) Interest payments                                                                       |           | 1567                  |
| (b) Portion of the interest payment that went for the dairy enterprise                         |           | 75%                   |
| (c) Multiply (a) by (b)                                                                        |           | 1175                  |
| 26 Get estimate for annual depreciation expenses of dairy enterprise. Divide this by figure 12 |           | 642                   |
| 27 Estimate total operating expenses by adding steps 9, 10(g), 11 through 24, 25(c) and 26     |           | 20,419                |
| 28 Estimate income over operating expenses by subtracting step 27 from step 6                  |           | 5,318                 |

From *How to Compute Your Cost of Producing Milk (G3651)*, University Extension agricultural publications, University of Missouri-Columbia.

of manure. Producers may store wastes in lagoons and holding tanks. Lagoons are artificial waste holding areas that resemble ponds. A water-tight concrete or coated steel tank may also be used for manure storage. The tank may be above or below ground.

Finally, dairy farms usually raise their own replacement females. Producers usually raise heifers in hutches where each is kept individually until weaning. After weaning, they are moved to group pens to be raised.

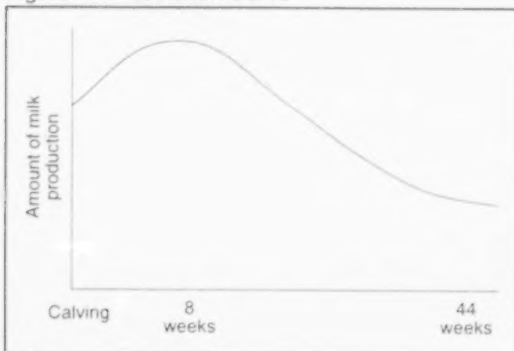
### Raising Dairy Replacements

Many dairy producers raise their own replacement animals; other producers specialize in raising replacement heifers for other producers. Dairy producers who raise replacement heifers should consider the number of females needed each year as well as proper development. Heifers should be ready to calve at approximately 24 months of age and weigh 1,000 to 1,300 pounds, depending on the breed. Careful feeding is essential if heifers are to reach this weight at the right time for breeding. Small, thin heifers give less milk. Producers should also not allow heifers to become too fat. Research has shown that excessive fat deposits in the udder may reduce future milk production.

### Reproductive Management

Good reproductive management is essential for success in the dairy industry. Cows must become pregnant and calve for milk production, or lactation, to begin. Lactation normally peaks at approximately eight weeks after calving. It then slowly declines, as shown on the graph in Figure 4.4.

Figure 4.4 - Lactation Curve



Cows must be rebred between 40 and 100 days after calving to maintain the cycle of milk production. The producer should "dry off," or stop milking, the cows at approximately 40 to 50 weeks of lactation, depending on the level of milk production and the expected calving date. Most dairy operators will dry cows off when milk production dips below 35 to 40 pounds daily. The dry period with no milk production allows the cow to replenish her body and rest and prepare to have her next calf. The dry period should last 40 to 70 days, with an average of 60 days. When the cow gives birth, the lactation cycle begins again.

Most dairy cows are artificially inseminated. Artificial insemination (AI) permits the dairy producer to use bulls that are genetically superior. It also helps control the spread of reproductive diseases. Artificial insemination permits producers to keep more accurate records about reproduction, including breeding dates used to calculate the expected calving dates needed to figure the proper dry period. Artificial insemination is also used because of the problems associated with keeping a dairy bull on the farm, since dairy bulls are often very aggressive. Some producers also use embryo transfer to increase the spread of superior genetics in the herd by using superior cows.

### Nutritional Requirements

Dairy cattle have the same basic nutritional needs as all animals. Dairy cattle require energy (from carbohydrates and fats), protein, vitamins, minerals, and water. However, lactating dairy cows produce a lot of milk, and they therefore require large quantities of feed stuffs. The cow's nutritional needs are highest when lactation peaks.

Lactating cows consume 3 to 4 percent of their body weight as dry matter. A 1,000 pound dairy cow would require 30 to 40 pounds of dry feed per day. Roughages (forages) should make up at least 40 percent of the diet to maintain correct microbe populations in the rumen. The cow's production level (pounds of milk produced daily) and body condition (thin to fat) determine the exact nutrient needs of the cow. The poorer a cow's body condition is, the higher her nutritional requirements will be; poor body condition also affects the lactation curve, which will not peak as high.

## Introduction to Dairy Production

### Feeding Dairy Cattle

Dairy producers can meet the nutritional needs of their cattle through different feeding methods. The traditional feeding method involves feeding forages and grain separately. Producers may feed the forages as pasture or as hay or silage. Protein supplements, or concentrates, are added to the diet to increase the amount of protein. They may be fed in the barn mangers or in the milking parlor during milking.

Management-intensive grazing can also be used effectively in dairy production. With management-intensive grazing, producers rotate cows between grazing units in a preplanned cycle; they are moved when they consume the forages on the grazing unit. This type of grazing system helps lower costs by reducing the costs associated with equipment for harvesting forages and purchased feeds.

A method of feeding that is becoming more common is feeding a total mixed ration (TMR). A total mixed ration is a mixture of all the feed ingredients needed by dairy cattle, including forages, grain, and supplements; the cattle receive all these components of their diet at once. The advantages of total mixed rations include being able to feed a precisely balanced ration and reduced labor. However, special equipment for weighing and mixing the ration must be purchased; existing facilities may also need to be modified to feed total mixed rations.

### Record Keeping in Dairy Operations

Proper record keeping is essential to successful dairy production. Dairy producers should record milk weights and milk composition test results and breeding and calving information for all the cows in their herd.

Milk composition test results are available from the Dairy Herd Improvement Association (DHIA). DHIA is a recording service that monitors and records information on milk production levels and milk composition for individual cows. The association also transfers records to the respective breed associations. Independent personnel collect these records to maintain the accuracy of the data. DHIA is a voluntary association, but many producers use its resources and services.

Dairy producers should also record when cows are bred and when they calve to maintain maximum

production per cow. Producers who use registered animals are required to provide actual birth dates and pedigrees listing the animal's ancestors for each animal registered with the breed association.

### Marketing Milk

Most of the milk sold is marketed through cooperatives, such as Mid-America Dairymen (Mid-Am). The producer is a member of the cooperative and sells milk directly to it. The cooperative combines milk from many producers. A larger quantity of milk gives it more marketing flexibility; the cooperative also has more options for places where the milk may be shipped.

The federal government sets base milk prices for producers to keep consumer milk prices fairly constant throughout the year. Producers receive bonuses based on the fat and protein content of their milk, low bacteria counts, and low somatic cell counts. Somatic cells are white blood cells, which fight infections. A low somatic cell count indicates that the herd is healthy.

### Summary

Dairying generally requires a significant investment. It has many associated costs, including large capital outlays for facilities and cows. Dairy operators must manage production carefully, be good nutritionists, and keep accurate records for success in the dairy industry. The United States government sets the base milk price received by producers. Most milk is marketed through a cooperative.

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Dairy production is similar to other livestock production systems in the sense that dairy producers must maintain high levels of herd health to be successful. Producers must be able to recognize, treat, and prevent health problems.

### Common Dairy Health Concerns

Dairy producers encounter many herd health challenges. Dairy cattle are susceptible to all of the diseases that affect beef cattle. However, health problems affecting the ability of a dairy cow to produce high quality milk are by far the most serious. If a dairy cow loses her ability to produce milk, she is no longer useful to the producer. Major dairy health concerns are milk fever, ketosis, hairy heel warts, foot rot, laminitis, and mastitis.

Milk fever - Milk fever results from a calcium imbalance in dairy cattle and involves abnormally low levels of calcium in the blood. Cows usually become ill after they begin lactation. Milk fever seems to be more prevalent in older high-producing animals. Symptoms include loss of appetite, staggering, and paralysis. If untreated, milk fever can cause death. A veterinarian can treat this illness by giving cows an intravenous injection of calcium. Prevention of milk fever involves feeding rations with correct levels of calcium and phosphorus to dry cows.

Ketosis - Ketosis is a nutritional problem. Cows that are underfed during the period of high lactation shortly after calving may develop ketosis. It causes reduced milk production. Other symptoms include weight loss and a fruity odor to the cow's breath and milk. Ketosis may be treated with injections of glucose or hormones. Feeding high energy diets to lactating dairy cattle can prevent this disorder.

Foot rot - Foot rot is caused by a wound between the toes. Symptoms are lameness, swelling, fever, decreased appetite, and a sharp decrease in milk production. Foot baths and antibiotics are used to control and treat the disease.

Hairy heel warts - This disease causes an extremely painful growth on the skin on the heels of the rear feet. Cows may avoid putting weight on their heels. The disease is also associated with decreased milk production. The infected area may be treated with the use of antibiotic sprays.

Laminitis - Laminitis, or founder, is caused by high concentrate levels combined with insufficient levels

of long fiber from forages for adequate cud chewing. This creates acidic conditions in the rumen. Symptoms include lameness and poor milking performance. Producers can prevent laminitis by careful management of feeding. Aggressive foot trimming may be required as well.

Mastitis - Of all the dairy diseases, mastitis causes the greatest economic losses. Countless dollars are lost through reduced milk sales resulting from mastitis each year. Mastitis is an infection of the cow's udder caused by bacteria entering the udder through a teat. The disease may also result from an injury to the cow's udder. It has an acute form and a chronic form.

Clinical or acute mastitis is easy to detect because the cow's udder is severely swollen, and the milk is bloody or clotted. Cows with clinical mastitis may show a loss of appetite. Their milk production is severely reduced.

Subclinical or chronic mastitis is harder to recognize because the symptoms are not as easy to see. Cows with the subclinical form of the disease usually have decreased milk production and an elevated somatic cell count. The milk may appear normal to the herd manager, or it may be a little watery.

### Prevention and Control of Mastitis

Because of the potential for economic losses to a dairy program from mastitis, prevention and control is critical to successful dairy operations. Proper sanitation is one of the most important parts of mastitis prevention. Milking equipment must be sanitary to keep cows from being infected by the milking units. Before milking, milkers should strip the teats, removing a small amount of milk that is higher in bacteria. They should then wash and dry the teats before attaching the milking units. After milking is completed, the teats should be dipped in an acceptable disinfectant. Milkers may also predip the teats before milking instead of washing them.

Producers should give tests at least once every month to detect the high somatic cell counts caused by subclinical mastitis. The California Mastitis Test (CMT) is one test used to look for mastitis in the herd. Producers can administer this test themselves. Laboratory tests can be used to determine somatic cell counts more accurately.

Producers also try to keep infections from starting during the dry period. They treat the cow's

## Introduction to Dairy Production

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mammary glands with long-lasting antibiotics that will combat infections and prevent mastitis.

If cows do suffer from mastitis, prompt treatment is essential. Producers can treat cows in several ways. Milking the cow frequently is one method; the toxins causing the infection can be milked out with repeated milkings. Some producers give cows an injection of oxytocin, which is a naturally occurring hormone causing milk secretion. The additional oxytocin allows the cow to be more completely milked out with a normal milking routine. Cows may also be given antibiotics to treat mastitis. However, the milk from cows treated with most antibiotics must be discarded instead of sold.

### Health Concerns of Raising Replacements

Producers separate most dairy replacements from their dams at a very young age, usually within one to three days after calving. They then put the lactating cows into production. After the calves are segregated, they are switched to a powdered milk replacer and started on grain after several weeks.

Several diseases can affect replacement dairy heifers. Diarrhea, or scours, is the biggest health concern of raising replacements. This disorder can cause severe dehydration if not properly treated. Other health problems include reproductive diseases such as brucellosis and leptospirosis. Brucellosis causes abortions, sterility, and reduced milk production. Leptospirosis also causes abortion. Diseases like infectious bovine rhinotracheitis (IBR), pasteurella (PI3), bovine virus diarrhea (BVD), and blackleg are also of concern to producers.

Producers must vaccinate their replacement heifers to prevent these diseases. Heifers should be vaccinated against IBR, PI3, BVD, and blackleg between weaning and eight months of age, with boosters given as appropriate. Heifers should be vaccinated against brucellosis at four to seven months of age. They should be vaccinated against leptospirosis and other reproductive diseases before breeding. Producers should consult their local veterinarian and/or animal health supplier for the exact timing of all vaccinations.

### Routes of Administration

Producers can administer animal health products in a variety of ways. Common routes of administration are intramuscular, subcutaneous, oral, intranasal, and intravenous. They are illustrated in Figure 5.1.

**Intramuscular (IM)** - Intramuscular injections are made into the muscle. They should be given in the neck, never along the back or hip of the animal. Intramuscular injections are used for antibiotics and some vaccines.

**Subcutaneous (Sub-Q)** - Subcutaneous injections are given between the skin and muscle. They should be given in the loose skin on the side of the neck. This route is recommended because of the potential for tissue damage when injections are given into muscle tissue.

**Oral** - An oral, or drench, is given through the animal's mouth. Dewormers and some vaccines are given orally.

**Intranasal (IN)** - Like nasal sprays used by humans, intranasal vaccines are sprayed into the nasal cavity.

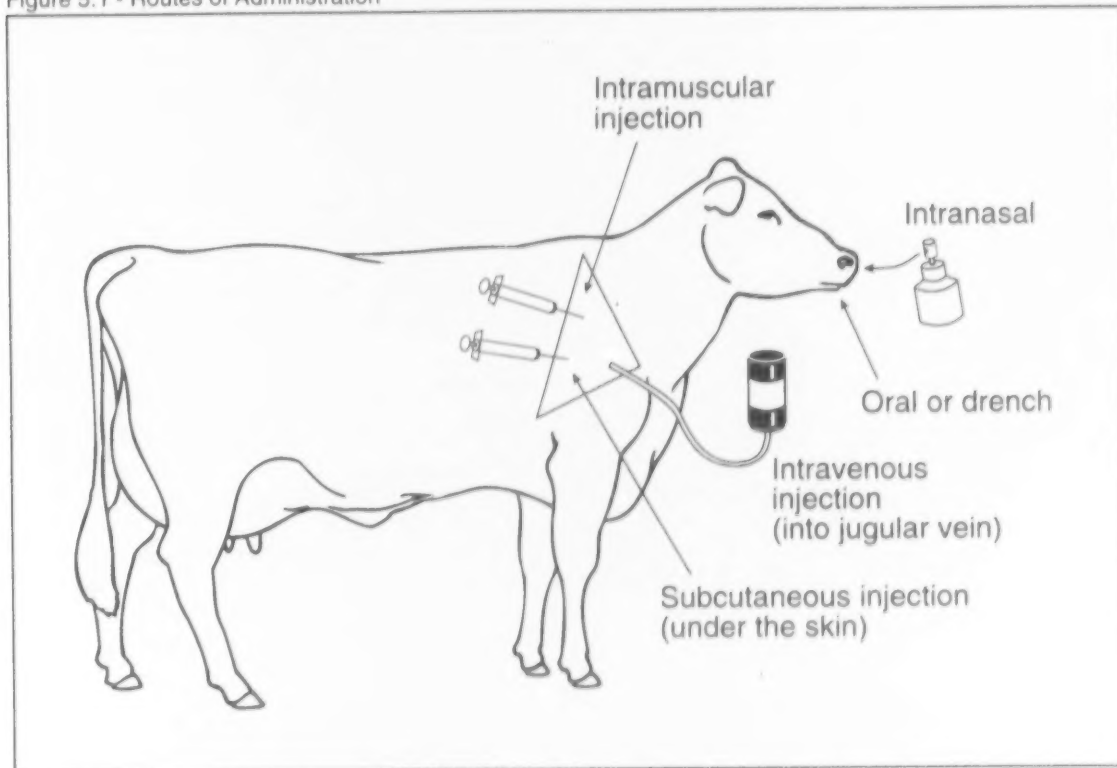
**Intravenous (IV)** - Intravenous treatments are given directly into the jugular vein of the animal. Either injections or actual drip IVs can be administered in this way.

Subcutaneous injections should be used whenever possible when injecting vaccines, but directions must be read and followed exactly! Dairy producers should always consult with their veterinarian first before giving any medical products to their animals. They should also read the labels on vaccines, dewormers, or medicine to check on the proper routes of administration, expiration date, and use of the product. The producer should be aware of withdrawal dates, which indicate the number of days after the injection is given before the cow's milk can be sold. Special precautions must be taken when using any animal health product on or around lactating cows. Producers must be certain that the product is approved for lactating cows.

### Summary

Dairy producers must be able to recognize and treat diseases in lactating cows such as milk fever, ketosis, and mastitis. Of these diseases, mastitis has the biggest economic impact because of losses in milk production. Producers should also be aware of health concerns for replacement heifers, since their health will affect future production. Any medications given to treat dairy cattle must be used correctly.

Figure 5.1 - Routes of Administration



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The American public is becoming more aware of agricultural production practices. People unfamiliar with animal agriculture frequently do not fully understand modern livestock management techniques. Dairy producers must be educated about industry issues to be able to address them effectively.

### Consumer Concerns

American consumers are concerned about waste management, the use of medications in lactating cows, and animal welfare.

Dairy production often takes place on a large scale and partially in confinement settings. Dairy cattle kept in confined areas produce large amounts of waste. Consumers worry that improperly handled, untreated wastes will contaminate ground and surface water.

Drugs given to lactating cows also concern the public. People sometimes fear that medications given to lactating cows end up in fluid milk. They believe that these drugs may be harmful to humans, since they are meant for use in cattle.

The welfare of dairy cattle is a third issue of concern to consumers. They are worried about how management practices affect animal comfort and well-being. Consumers fear, for example, that cows and calves do not have sufficient freedom to move around and that cattle may not always be adequately supplied with shade and shelter.

### Addressing Consumer Concerns

Dairy producers and the dairy industry are working to address consumer concerns about waste management, medications, and animal welfare. The National Milk Producers Federation and the Milk and Dairy Beef Quality Assurance Center are two industry organizations that provide information to producers about practices that might concern consumers. Their goal is to improve the quality of milk and dairy beef products by educating producers about management practices. The industry is also working to educate consumers about dairy production.

The industry is educating dairy producers about proper waste storage, management, and land application of wastes to avoid incidents that could damage the industry. Dairy producers must be

aware of environmental laws and conscious of their part in preserving the environment.

The industry organizations mentioned above have initiated Milk and Dairy Beef Quality Assurance programs. They are designed to educate producers about management practices that can help them produce high quality milk and pure beef products. The voluntary programs focus on several points that can help producers improve their milk, including proper herd health management, sanitation, feeding, and record keeping.

Information on taking care of dairy cattle is also available to educate producers about management practices that will ensure animal welfare. For example, the American Farm Bureau and other dairy-related agencies have produced a two-part series of booklets about caring for dairy animals. The goal of producers is to provide care that results in productive, healthy, contented cows.

### Food Safety

The consumers of American dairy products can be sure that products are safe because of inspections by the United States Department of Agriculture (USDA) and state regulatory agencies. State inspections are generally carried out twice a year to look at factors such as drug usage and sanitation in the milking parlor. When milk is picked up from the producer, samples are tested for contaminants at both the farm and the processing plant to confirm that the milk is safe for fluid use or for further processing into products such as cheese, ice cream, and yogurt. Milk that is unfit for human use is added to animal feeds or dumped. Milk quality is monitored from the time it leaves the dairy until it reaches the consumer's home.

### Conclusion

Dairy producers must address the concerns of the consumers of dairy products. By learning more about these issues and improving their management practices, producers can show that they can produce safe dairy foods in an environmentally conscious way. Industry groups and producers are also working to educate consumers about dairy production and the safety of dairy products. The USDA plays an important role in assuring the safety of these foods.

## *Introduction to Dairy Production*

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